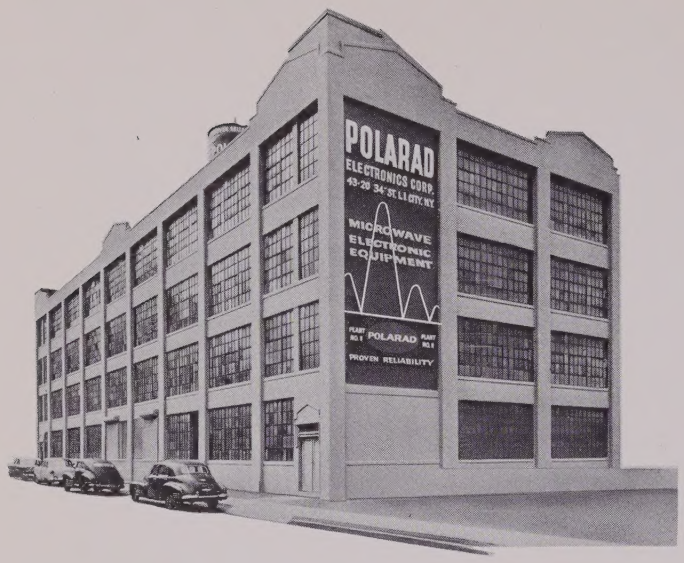
POLARAD

HANDBOOK
OF
OPERATING INSTRUCTIONS

MICROWAVE FIELD INTENSITY METER MODEL FIM-2

VOLUME I

POLARAD ELECTRONICS CORPORATION, 43-20 34th STREET, LONG ISLAND CITY 1, N.Y.



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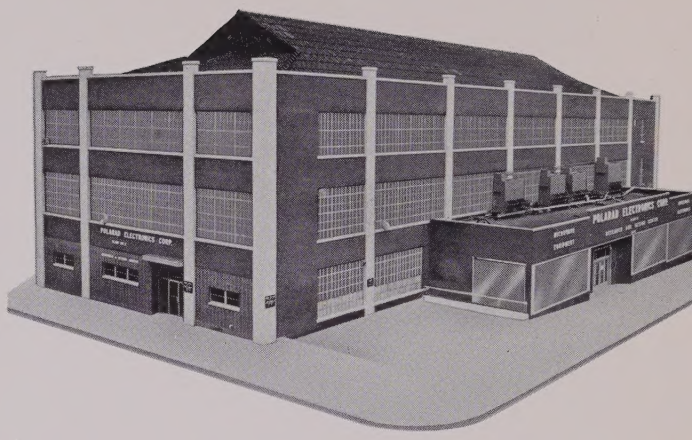

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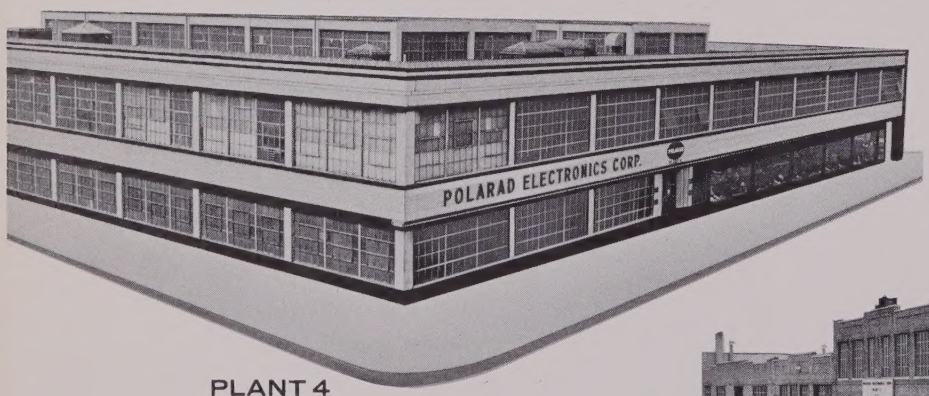

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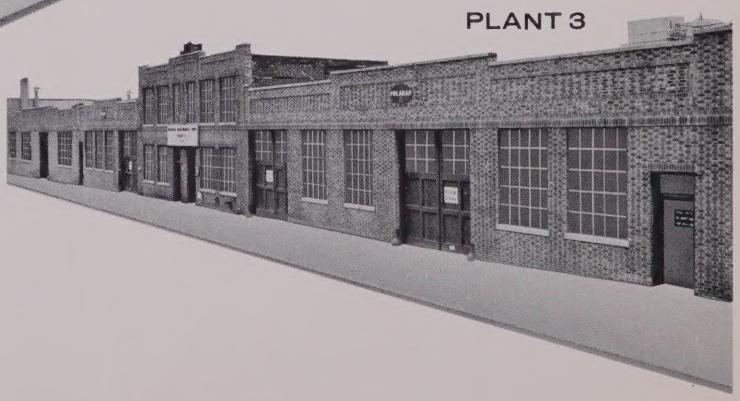

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POLARAD

INSTRUCTION MANUAL

MICROWAVE FIELD INTENSITY METER MODEL FIM-2

VOLUME I

SERIAL NOS. 250 AND UP

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WARNING:

EXPOSURE TO RADIATION FIELDS GREATER THAN 10 MILLIWATTS PER SQUARE CENTIMETER IS DANGEROUS AND CAN BE FATAL TO HUMAN LIFE.

LEGEND

1. Basic Unit, Model FIM-B2
2. Tuning Unit, Model FIM-X2
3. Calibrated Broadband Omnidirectional Conical Antenna, Model CA-B
4. Calibrated Direction Antenna, Model CA-L
5. Calibrated Direction Antenna, Model CA-S
6. Calibrated Feed Horn, Model CA-M
7. Calibrated Feed Horn, Model CA-X
8. Parabolic Reflector, Model CA-R
9. Antenna Tripod, Model CA-T
10. Electrical Power Cable Assembly W1201
11. Power Cable Adapter CP1201
12. R-f Cable Assembly W1202
13. R-f Cable Assembly W1203
14. I-f Cable Assembly W1204
15. R-f Cable Assembly W1205
16. Patch Cable Assembly W1206
17. D-c Blocking Capacitor C1201
18. Feed Horn Bolt H1201
19. Wrench Kit H1202
20. Allen Wrench H1203
21. Klystron Wrench H1204
22. Klystron Wrench H1205

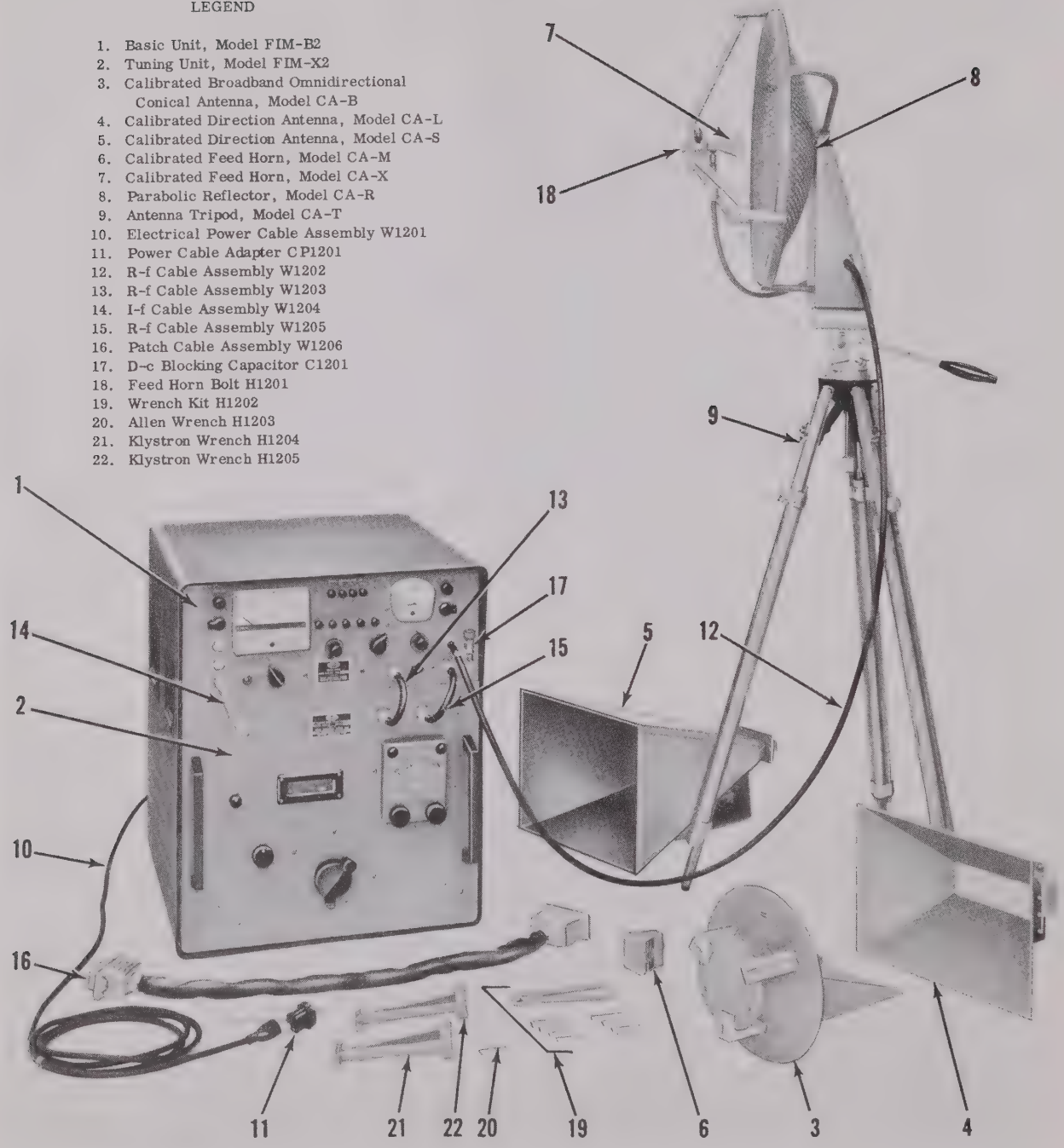


Figure 1-1. Model FIM-2 Field Intensity Meter

SECTION I

INTRODUCTION

1-1. SCOPE OF MANUAL.

1-2. This manual contains instructions for the use and maintenance of the Model FIM-2 Field Intensity Meter, shown in figure 1-1, which is manufactured by Polarad Electronics Corporation, Long Island City, New York. The manual includes a general description of the equipment, operating instructions, theory of operation, maintenance information, and schematic diagrams.

1-3. PURPOSE AND USE OF THE EQUIPMENT.

1-4. The Model FIM-2 Field Intensity Meter, hereafter referred to as the FIM-2, provides an accurate indication of the frequency and magnitude of an r-f signal lying within the frequency range from 1,000 to 10,000 mc. The amplitude of either narrowband (cw) or broadband (pulsed) r-f signals is read directly from a calibrated output voltmeter having three scales: microvolts, decibels above one microvolt, and decibels above one microvolt per megacycle. In addition to being a sensitive and frequency-selective microwave receiver, the FIM-2 also provides a self-contained calibrated microwave signal generator which covers the same frequency range. Specific uses of the FIM-2 include:

a. Field intensity measurements.

b. Measuring the absolute level of r-f interference in accordance with military and commercial specifications.

c. Determining the susceptibility of other instruments and components to external r-f interference.

d. Measuring the radiation level of receiver local oscillators

e. Sensitive r-f voltmeter (power meter)

f. Antenna pattern analysis

g. Determining the shielding effectiveness of screen rooms

h. Determining the harmonic and spurious frequency outputs of transmitters

i. Propagation studies.

j. Measuring r-f leakage

k. Analyzing r-f signals

l. Analyzing the characteristics of microwave transmitters, receivers, and components.

1-5. GENERAL DESCRIPTION.

1-6. The FIM-2 is a self-contained, compact unit consisting of the Model FIM-B2 Basic Unit and four interchangeable plug-in Tuning Units (Models FIM-L2, FIM-S2, FIM-M2, and FIM-X2). In operation, one of the four plug-in Tuning Units is mounted in the Basic Unit so that the two combine to appear as a single assembly, as shown in figure 1-1.

1-7. The Model FIM-B2 Basic Unit, which contains the control and monitoring circuitry of the FIM-2 system, consists of a panel, chassis, and frame assembly. The front panel assembly occupies the upper front half of the equipment frame and serves as a mounting for the Basic Unit operating controls, indicators, and connectors. The bottom section of the Basic Unit frame has a panel opening which is designed to accept one of the four interchangeable plug-in Tuning Units.

1-8. Each interchangeable plug-in Tuning Unit contains the r-f receiving and signal generating circuitry which is continuously tunable throughout the complete frequency range of the particular Tuning Unit. Its front panel assembly serves as a mounting for the Tuning Unit operating controls, indicators, and connectors.

1-9. FIM-2 SYSTEM COMPONENTS.

1-10. Table 1-1 lists the components comprising the complete FIM-2 system, which is shown in figure 1-1. This list includes the entire complement of Tuning Units and accessories. Note that the Tuning Units and accessories are supplied under the conditions described in paragraphs 1-11 through 1-19.

1-11. MODEL FIM-B2 BASIC UNIT. The Basic Unit, which is the control and monitoring portion of the FIM-2 system, is supplied as an integral component.

1-12. INTERCHANGEABLE PLUG-IN TUNING UNITS. The four Tuning Units avaliable are supplied as ordered. These include:

a. MODEL FIM-L2 TUNING UNIT. This Tuning Unit covers the frequency range from 1,000 to 2,240 mc.

b. MODEL FIM-S2 TUNING UNIT. This Tuning Unit covers the frequency range from 2,140 to 4,340 mc.

c. MODEL FIM-M2 TUNING UNIT. This Tuning Unit covers the frequency range from 4,200 to 7,740 mc.

d. MODEL FIM-X2 TUNING UNIT. This Tuning Unit covers the frequency range from 7,360 to 10,000 mc.

1-13. CALIBRATED ANTENNAS. Four calibrated directional antennas and one calibrated broadband omnidirectional antenna, each having a nominal output impedance of 50 ohms, are available and are supplied

TABLE 1-1. FIM-2 SYSTEM COMPONENTS.

Component	Polarad Model or Part No.	Figure 1-1 Index Number	Overall Dimensions (in.)			Weight (lbs)
			Length	Width	Height	
Basic Unit	FIM-B2	1	25	19	23-1/2	[illegible]
Tuning Unit	FIM-L2	Not Shown	12-1/4	18-1/2	15-5/8	50
Tuning Unit	FIM-S2	Not Shown	12-1/4	18-1/2	15-5/8	50
Tuning Unit	FIM-M2	Not Shown	12-1/4	18-1/2	15-5/8	50
Tuning Unit	FIM-X2	2	12-1/4	18-1/2	15-5/8	50
Calibrated Broadband Omnidirectional Conical Antenna	CA-B	3	10-19/32	9-3/16 dia		2.5
Calibrated Directional Antenna	CA-L	4	8	9-7/16	13-3/4	2.0
Calibrated Directional Antenna	CA-S	5	17-11/32	10-1/2	13-29/32	3.5
Calibrated Feed Horn	CA-M	6	2-5/16	2-1/4	2-1/4	0.5
Calibrated Feed Horn	CA-X	7	2-13/32	1-7/16	3-11/32	0.5

Antenna Tripod	CA-T	9	5 dia		37-3/8	5.0
Electrical Power Cable Assembly W1201	B111144	10	10 ft	7/16 dia		1.5
Power Cable Adapter CP1201	A131966	11	1	1-1/2 dia		0.3
R-f Cable Assembly W1202	A109817	12	6 ft	1/2 dia		1.5
R-f Cable Assembly W1203	A140572	13	9-3/4	1/2 dia		0.3
I-f Cable Assembly W1204	A140571	14	7-1/4	1/4 dia		0.2
R-f Cable Assembly W1205	A140572	15	9-3/4	1/2 dia		0.3
Patch Cable Assembly W1206	B140565	16	30-1/2	-	-	4.0
D-c Blocking Capacitor C1201	A702098	17	2	1 dia		0.2
Feed Horn Bolt H1201	A100885	18	1-1/2	1 dia		0.1
Wrench Kit H1202	A25109	19	-	-	-	1.0
Allen Wrench H1203	A515305	20	-	-	-	0.1
Klystron Wrench H1204	B144478	21	6-1/4	2 dia		0.5
Klystron Wrench H1205	B144525	22	6-1/4	2 dia		0.5

as ordered. These include:

a. MODEL CA-L CALIBRATED DIRECTIONAL ANTENNA. This antenna is used in conjunction with the Model FIM-L2 Tuning Unit.

b. MODEL CA-S CALIBRATED DIRECTIONAL ANTENNA. This antenna is used in conjunction with the Model FIM-S2 Tuning Unit.

c. MODEL CA-M CALIBRATED FEED HORN. This feed horn is used in conjunction with the Model FIM-M2 Tuning Unit.

d. MODEL CA-X CALIBRATED FEED HORN. This feed horn is used in conjunction with the Model FIM-X2 Tuning Unit.

e. MODEL CA-B CALIBRATED BROADBAND OMNIDIRECTIONAL CONICAL ANTENNA. This broadband antenna may be used in conjunction with any one of the four Tuning Units.

1-14. MODEL CA-R PARABOLIC REFLECTOR. This parabolic reflector, which is supplied only when specifically ordered, is used to focus the input signal at the center of either the Model CA-M or CA-X Calibrated Feed Horn, thereby effectively increasing the areas of these feed horns.

1-15. MODEL CA-T ANTENNA TRIPOD. This antenna tripod, which is supplied only when ordered, is used as a mount for the individual calibrated antennas. Either vertical or horizontal polarization of the antenna may be selected, depending on their orientation. The tripod mounting bracket permits 360-degree rotation in azimuth and 180-degree rotation in elevation. Two locking levers permit locking of the mounted antenna in any position. The tripod legs can be extended from a minimum of 37-3/8 inches to a maximum of 60 inches.

1-16. CABLE ASSEMBLIES. The following cable assemblies are supplied with the equipment:

a. ELECTRICAL POWER CABLE ASSEMBLY W1201 (10 feet long). Input power to the FIM-2 is applied from a 115/230-volt, 50 to 450-cps power outlet via this detachable cable assembly. One termination is a standard three socket connector for mating with the Basic Unit power input receptacle. The other termination is a standard three-prong connector for mating with a polarized power outlet.

b. R-F CABLE ASSEMBLY W1202 (6 feet long). This cable assembly, consisting of type RG-9B/U coaxial cable terminated with type UG-21D/U connectors at each end, is employed to couple the r-f signal under measurement from the calibrated antenna output connector to the Basic Unit RF IN jack.

c. R-F CABLE ASSEMBLIES W1203 AND W1205 (9-3/4 inches long). These cable assemblies, each consisting of type RG-9B/U coaxial cable terminated with type UG-21D/U connectors at each end, are employed as front panel jumpers: W1203 to couple the Basic Unit ATTEN OUT jack to the Tuning Unit PRESEL IN jack; W1205 to couple the Tuning Unit SIG GEN OUT jack to the Basic Unit CAL IN jack.

d. I-F CABLE ASSEMBLY W1204 (7-1/4 inches long). This cable assembly, consisting of type RG-55/U coaxial cable terminated with type UG-88/U connectors at each end, is employed as a front panel jumper to couple the Tuning Unit MIXER OUT jack to the Basic Unit IF IN jack.

e. PATCH CABLE ASSEMBLY W1206 (30-1/2 inches long). This harnessed cable assembly, terminated at each end with multipin connectors, is employed to interconnect the Tuning Unit and Basic Unit when performing routine maintenance operations.

1-17. HARDWARE. The hardware listed below is either supplied with the equipment or available as an accessory, as indicated:

a. FEED HORN BOLT H1201. This bolt is supplied with the Model CA-R Parabolic Reflector (an accessory supplied only when specifically ordered) for mounting the Model CA-M or Model CA-X Calibrated Feed Horn to the reflector.

b. WRENCH KIT H1020. This kit is supplied with the equipment and contains the hand tools required to adjust and align the FIM-2. The contents of this kit are listed below in table 1-2.

TABLE 1-2. WRENCH KIT TOOLS.

Tool	Polarad Part No.
Spanner Wrench H1206	AP15550
No. 4 Spline Wrench H1207	A515101
No. 6 Spline Wrench H1208	A515102
No. 8 Spline Wrench H1209	A515103
No. 10 Spline Wrench H1210	A515104
No. 4 Allen Wrench H1211	A515301
No. 6 Allen Wrench H1212	A515302
No. 8 Allen Wrench H1213	A515303
No. 10 Allen Wrench H1214	A515304

c. ALLEN WRENCH H1203. This 1/8-inch allen wrench is supsupplied with the Model CA-T Antenna Tripod (an accessory supplied only when specifically ordered), and is used to adjust the position of the tripod mounting screw.

d. KLYSTRON WRENCHES H1204 AND H1205. These klystron wrenches are supplied with the Tuning Unit ordered. Klystron wrench H1204 is employed to position the reflex klystrons used in the Model FIM-L2 and Model FIM-S2 Tuning Units; klystron wrench H1205 is used

to position the reflex klystrons employed in the Model FIM-M2 and Model FIM-X2 Tuning Units.

1-18. D-C BLOCKING CAPACITOR C1201. This capacitor is supplied chained to the CAL IN jack and is used in conjunction with the SIG GEN OUT jack when the FIM-2 is employed as a calibrated microwave signal generator for susceptibility to conducted interference tests in conjunction with a line stabilization network.

1-19. POWER CABLE ADAPTER CP1201. This adapter is supplied with the equipment and is used to adapt a two-wire power outlet to the polarized three-prong connector terminating electrical power cable assembly 1201.

1-20. TECHNICAL CHARACTERISTICS.

1-21. The technical characteristics of the FIM-2 are listed below.

Frequency range (field intensity meter and calibrated microwave signal generator)	1,000 to 10,000 mc in four overlapping bands
Model FIM-L2 Tuning Unit	1,000 to 2,240 mc
Model FIM-S2 Tuning Unit	2,140 to 4,340 mc
Model FIM-M2 Tuning Unit	4,200 to 7,740 mc
Model FIM-X2 Tuning Unit	7,360 to 10,000 mc
Frequency dial calibration accuracy	±1%
Receiver type	Triple-conversion superheterodyne
Minimum r-f sensitivity	20 microvolts (-81 dbm)
Maximum r-f input signal	3 volts rms (+22.5 dbm)
Input impedance	50 ohms nominal
Impulse bandwidth	5 mc
Image and spurious response rejection	60 db
Signal attenuation	0 to 80 db in 1-db steps
R-f	0 to 60 db in 20-db steps
I-f	0 to 20 db in 1-db steps

Intermediate frequencies	Three
First	260 mc
Second	140 mc
Third	40 mc
Calibration signal	0.223 volts rms to 5 microvolts (0 to -95 dbm) ±1 db with correction chart
External Modulation	Square wave; 50 volts minimum (peak-to-peak)
	Positive pulse; +50 to +100 volts peak; 1 to 10,000 pps; 1 us wide to 50% duty cycle (Basic Unit serial nos. 291, 294, 297, 298, 307 to 312, 315, 316, 321, and 322)
Measurements	Average, quasi-peak, slideback-peak, and direct peak
Weighting circuit time constants:	
Average and slideback-peak	0.1 usec charge time; 0.3 usec discharge time
Quasi-peak	50 usec charge time; 500 millisec discharge time
Peak	0.1 usec charge time; 2.0 usec discharge time
Audio output	100 milliwatts into 600 ohms
Video output	0.5 volts (minimum) into 2 megohms
Recorder output	0 to 0.1 volt into 100K
Power requirements	115 or 230 volts (±10%); 50 to 450 cps single-phase; 700 watts

1-22. ELECTRON TUBE, CRYSTAL DIODE, SEMICONDUCTOR, FUSE, AND INDICATOR LAMP COMPLEMENT.

1-23. Table 1-3 lists the types and quantities of the entire complement of electron tubes, crystal diodes, and semiconductors employed in the FIM-2 system. The types and quantities of the fuses and indicator lamps are listed in table 1-4.

TABLE 1-3. ELECTRON TU

ASSEMBLY	ELECTRON TUBE														
	B600	SV5	OA2	OB2	1N23D	1N54	1N69	1N82A	1N91	1N198	1N459	1N1218	1N1341	1N2361	
Model FIM-L2 Tuning Unit					1										
Model FIM-S2 Tuning Unit					1										
Model FIM-M2 Tuning Unit					1										
Model FIM-X2 Tuning Unit															
260/140 - Mc Preamplifier								1							
140/40 - Mc I-f Amplifier															
Crystal - Controlled Local Oscillator															
Afc-I-f Amplifier							2								
Audio-Metering Chassis															
Low-Voltage Power Supply and Front Panel Circuitry	4	1		1		1			1	1	1	4	2		
High-Voltage Power Supply			3	1										8	
Model FIM-B2 Basic Unit	4	1	3	2		1	2	1	1	1	1	4	2	8	
TOTALS	4	1	3	2	3	1	2	1	1	1	1	4	2	8	

Notes: 1. See table 3-1.
2. Total in Model FIM-B2 Basic Unit.
3. Total in complete FIM-2 system.

BE, CRYSTAL DIODE, AND SEMICONDUCTOR COMPLEMENT

, CRYSTAL DIODE, AND SEMICONDUCTOR TYPE																								TOTALS
IN2510	2E4	2N207	2N277	2N456	6AH6	6AK5	6AL5	6AN5	6AQ5	6AR6	6AS7	6AU6	6U8	12AT7	12AX7	50M140ZR5	61 - 1501	807	5687	5876	7049/ZV1009	7505/ZV1010	8052/ZV1011	
																	2					2[1]		5
																	2				2[1]			5
																	2						2[1]	5
1																	2						2[1]	5
																				2				3
						7	1	1											1					10
						3								1										4
						2						4												8
									1			1	1	1	1									5
	4	1	2	1							2	1				1								28
					1					1					2			2							18
	4	1	2	1	1	12	1	1	1	1	2	6	1	2	3	1		2	1	2				76[2]
1	4	1	2	1	1	12	1	1	1	1	2	6	1	2	3	1	8	2	1	2	2	2	4	96[3]

TABLE 1-4. FUSE AND INDICATOR LAMP COMPLEMENT.

Type	Quantity
FUSES	
3AG, 1/16 amp, 250 volts, SLO BLO	1
3AG, 150 ma, 125 volts, SLO BLO	1
3AG, 6 amps, 250 volts	2
3AG, 2 amps, 250 volts	1
3AG, 8 amps, 32 volts, SLO BLO	1
INDICATOR LAMPS	
47	8
328	8
NE51	2

SECTION II

OPERATION

2-1. PRELIMINARY INSPECTION.

2-2. The FIM-2 is shipped complete and ready to use upon delivery. After unpacking the system, inspect the equipment for possible damage that might have been incurred during shipment as outlined in the following steps.

a. Inspect the front panel handles, captive-lock fasteners, and connectors for security of mounting.

b. Inspect the exterior of the equipment to ascertain that it is free from dents, gouges, and scratches.

c. Inspect the front panel controls for rotation without binding, proper indexing with panel markings, ease of operation, and tightness on their shafts.

WARNING

THE FIM-2 (WITH A PLUG-IN TUNING UNIT INSTALLED) WEIGHS APPROXIMATELY 200 POUNDS. TWO PEOPLE SHOULD BE EMPLOYED AT ALL TIMES WHEN UNPACKING, LIFTING, TRANSPORTING, OR REPACKING THE EQUIPMENT.

d. Grasp the FIM-2 by its four recessed handles and place it on a work bench with the rear of the equipment facing the operator.

e. Turn each of the four captive-lock fasteners (one located at each corner at the rear of the dust cover) one-quarter turn counterclockwise with the aid of a screwdriver.

f. Carefully turn the FIM-2 around so that the front panel faces the operator.

g. With two men working on the FIM-2 (one on each side of the equipment), grasp the two Tuning Unit front panel handles. Carefully slide the FIM-2 forward and out of its dust cover.

h. With the component parts mounted on the Basic Unit and Tuning Unit now visible and accessible, inspect the FIM-2 to make certain that all electron tubes are firmly seated in their sockets with their shields or clamps properly in place.

i. Examine the inter-assembly cabling (see figure 5-8) to ascertain that all cable connectors are securely attached to their mating receptacles.

j. Replace the FIM-2 into its dust cover and secure it by turning the four captive-lock fasteners one-quarter turn clockwise.

2-3. EQUIPMENT INSTALLATION.

2-4. After inspecting the FIM-2, plan its location. The FIM-2 is furnished in a cabinet mounted configuration, as shown in figure 2-1. Figures 2-2 through 2-8 are installation outline drawings of a typical Tuning Unit and the available optional accessories.

2-5. OPERATING CONTROLS, INDICATORS, AND CONNECTORS.

2-6. The operating controls, indicators, and connectors necessary for the operation of the FIM-2 are located on the Basic Unit and Tuning Unit front panel assemblies, as shown in figure 2-9. Their functions are described in table 2-1.

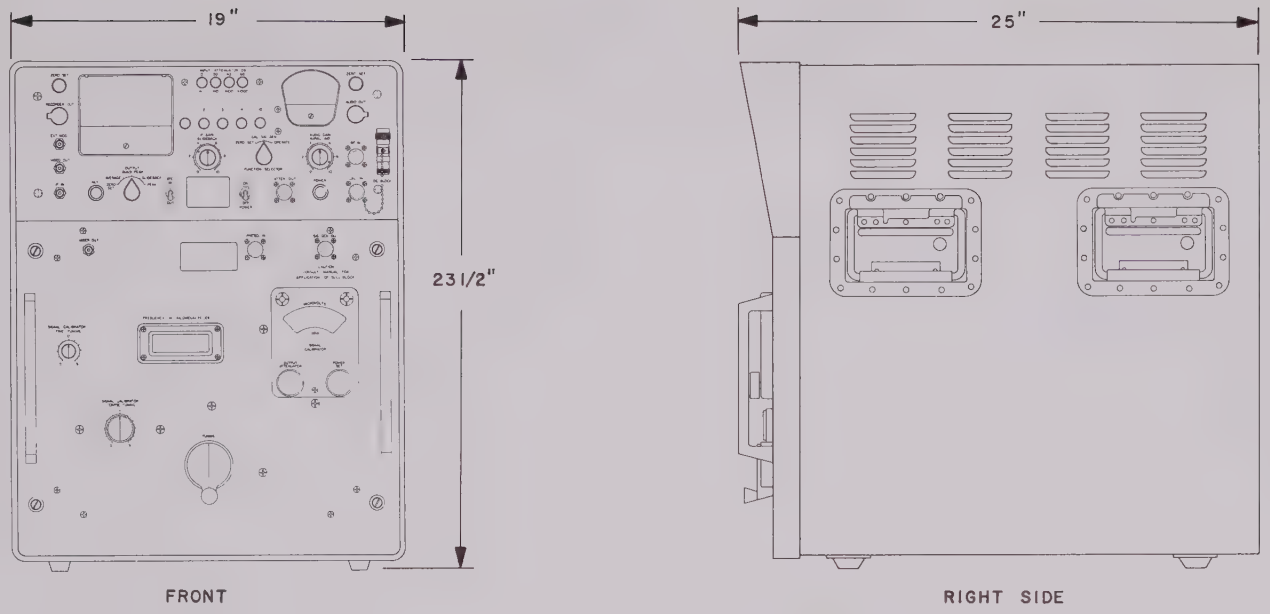


Figure 2-1. Model FIM-B2 Basic Unit with Typical Tuning Unit Installed, Installation Outline Drawing

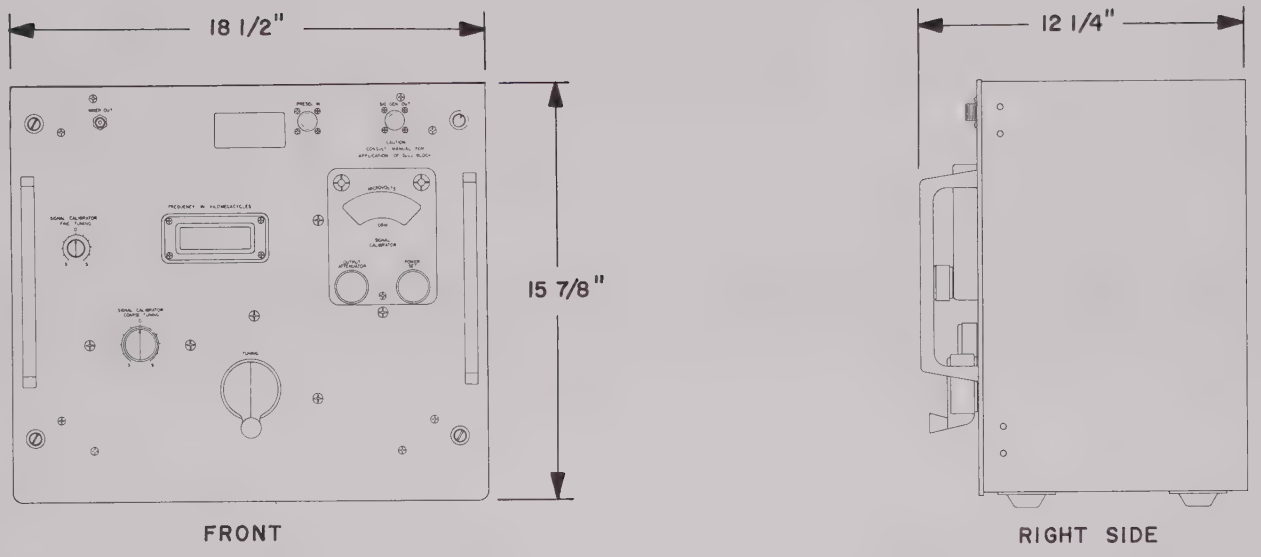


Figure 2-2. Typical Tuning Unit in Storage Container, Installation Outline Drawing

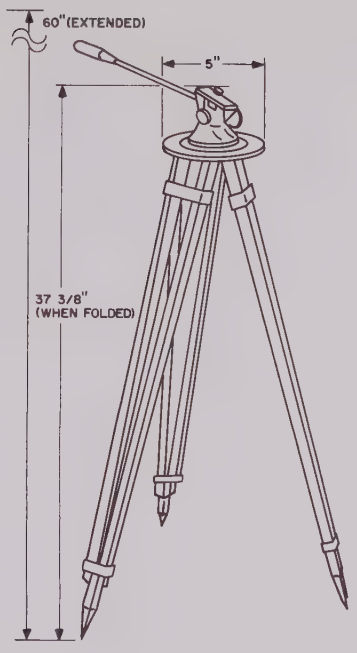


Figure 2-3a. Model CA-T Antenna Tripod, Installation Outline Drawing

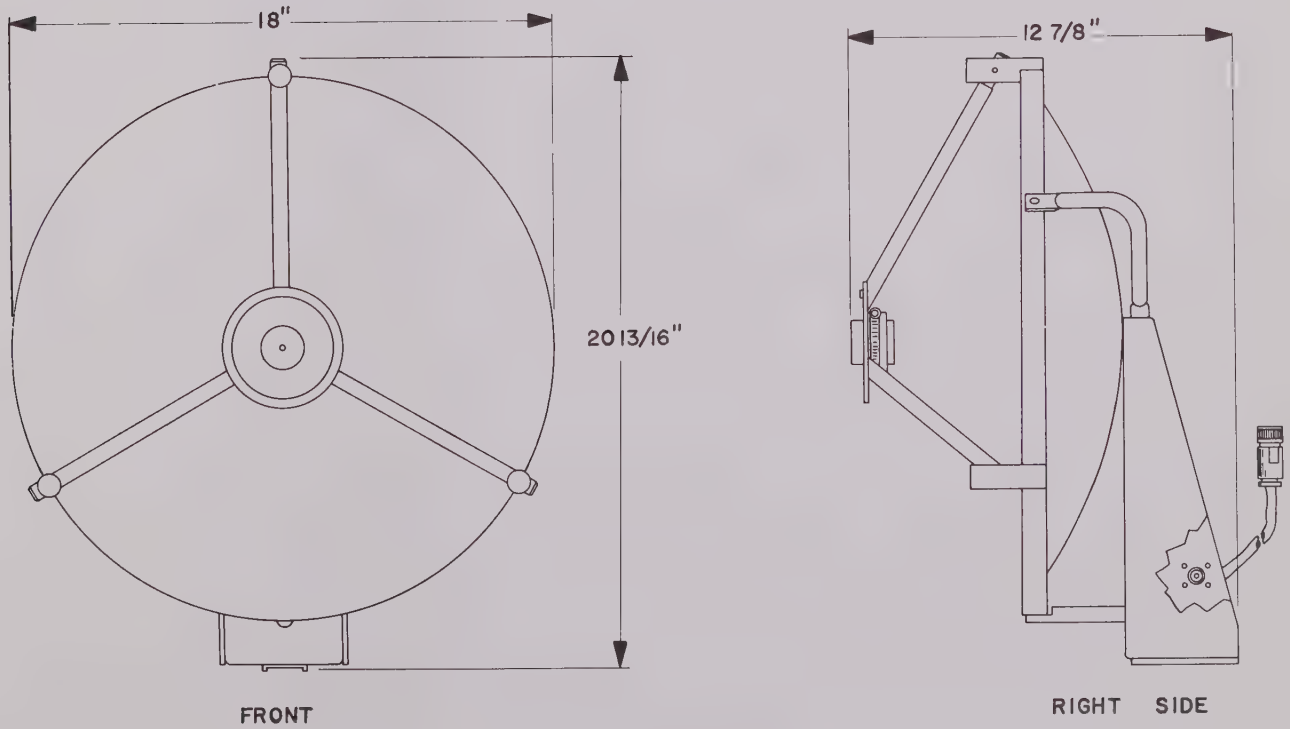


Figure 2-3b. Model CA-R Parabolic Reflector, Installation Outline Drawing

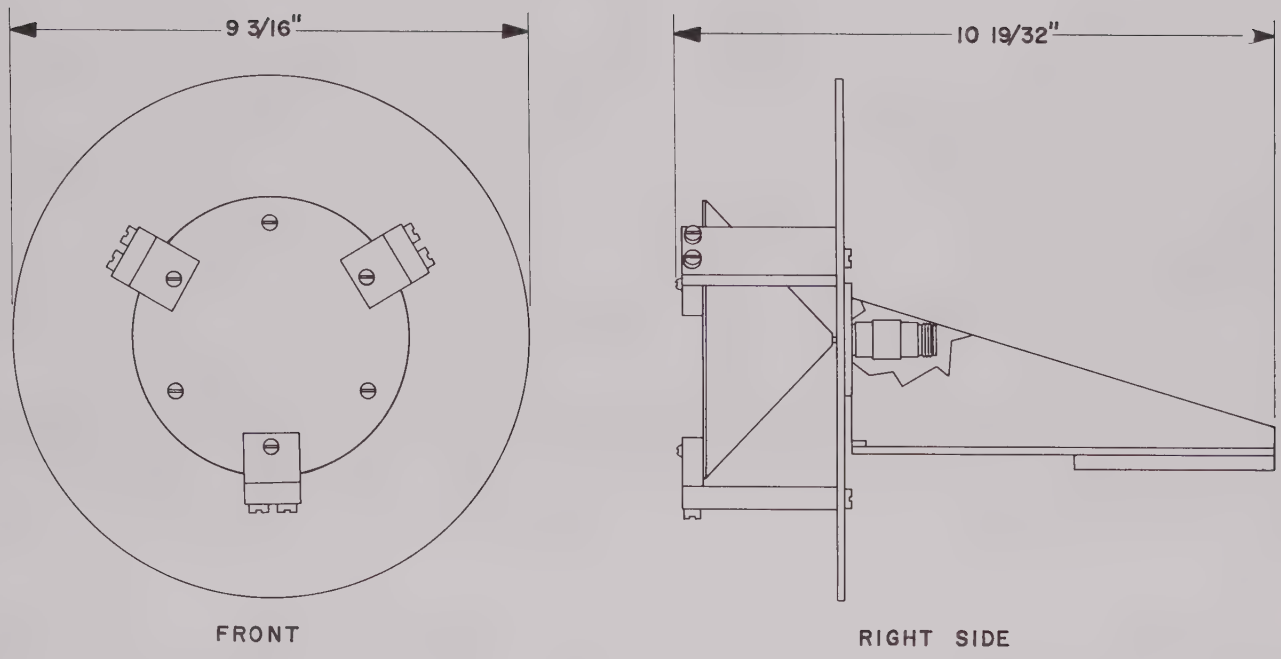


Figure 2-4. Model CA-B Calibrated Broadband Omnidirectional Conical Antenna, Installation Outline Drawing

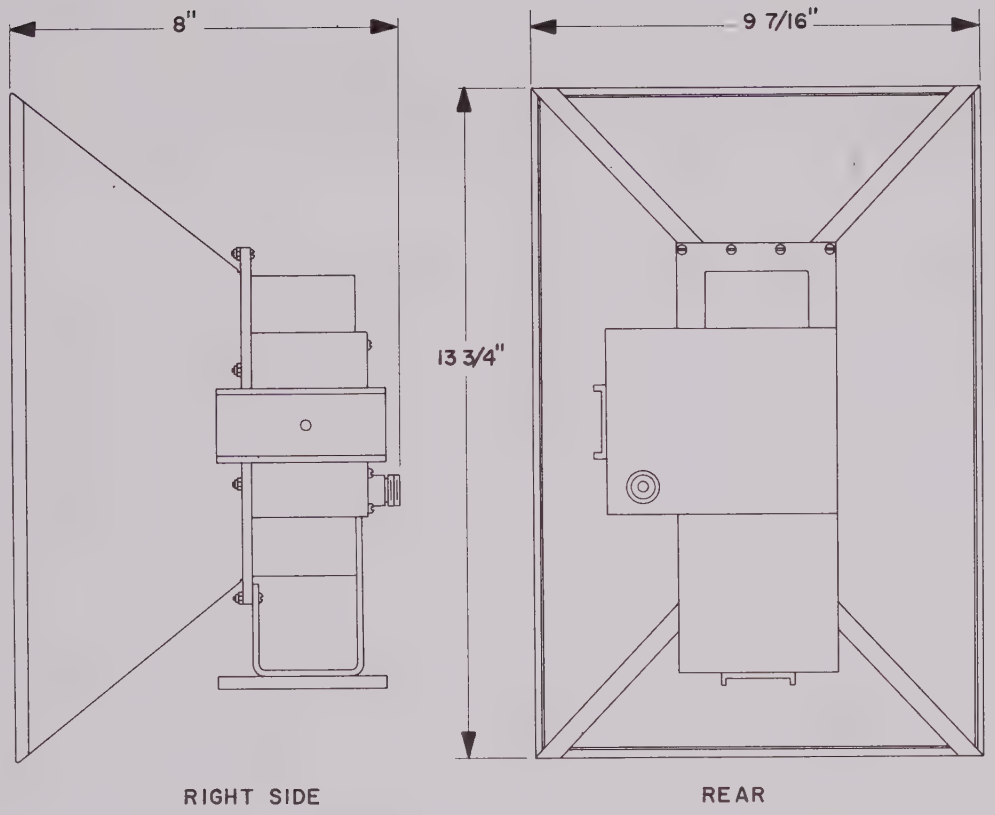


Figure 2-5. Model CA-L Calibrated Directional Antenna, Installation Outline Drawing

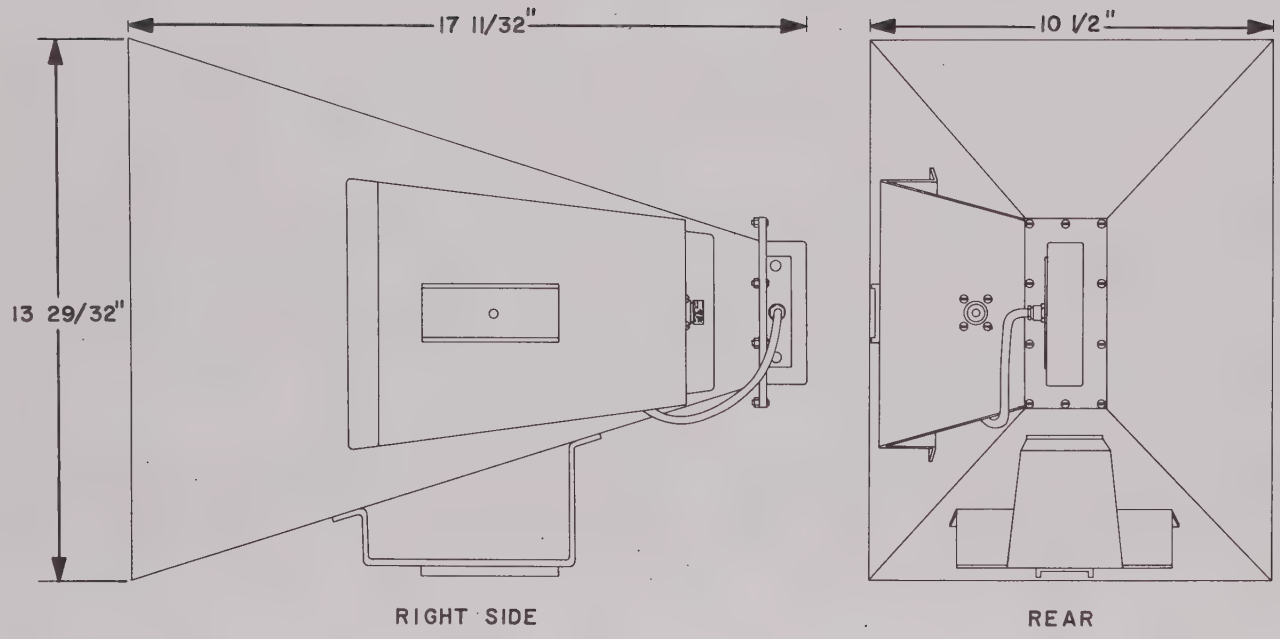


Figure 2-6. Model CA-S Calibrated Directional Antenna, Installation Outline Drawing

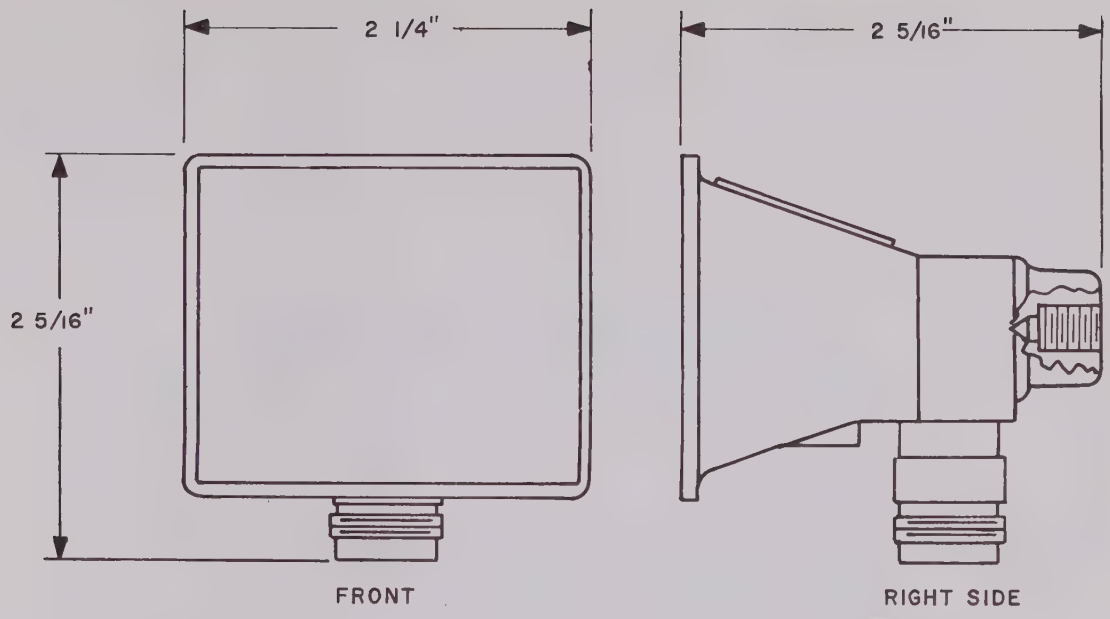


Figure 2-7. Model CA-M Calibrated Feed Horn, Installation Outline Drawing

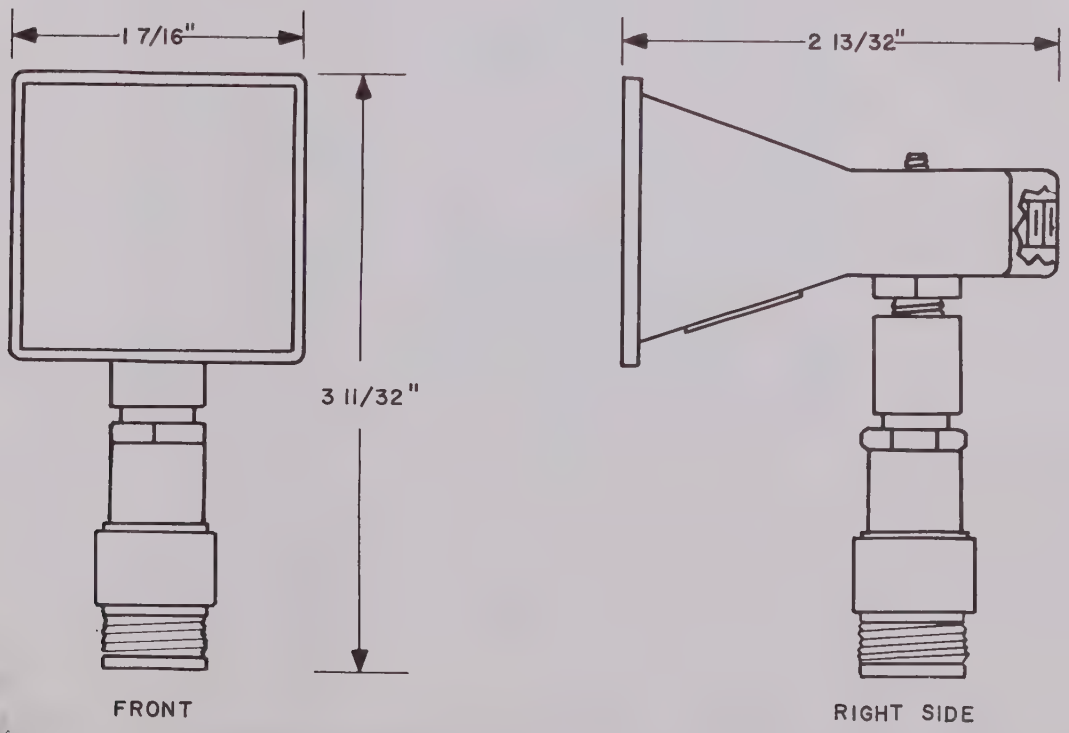


Figure 2-8. Model CA-X Calibrated Feed Horn, Installation Outline Drawing

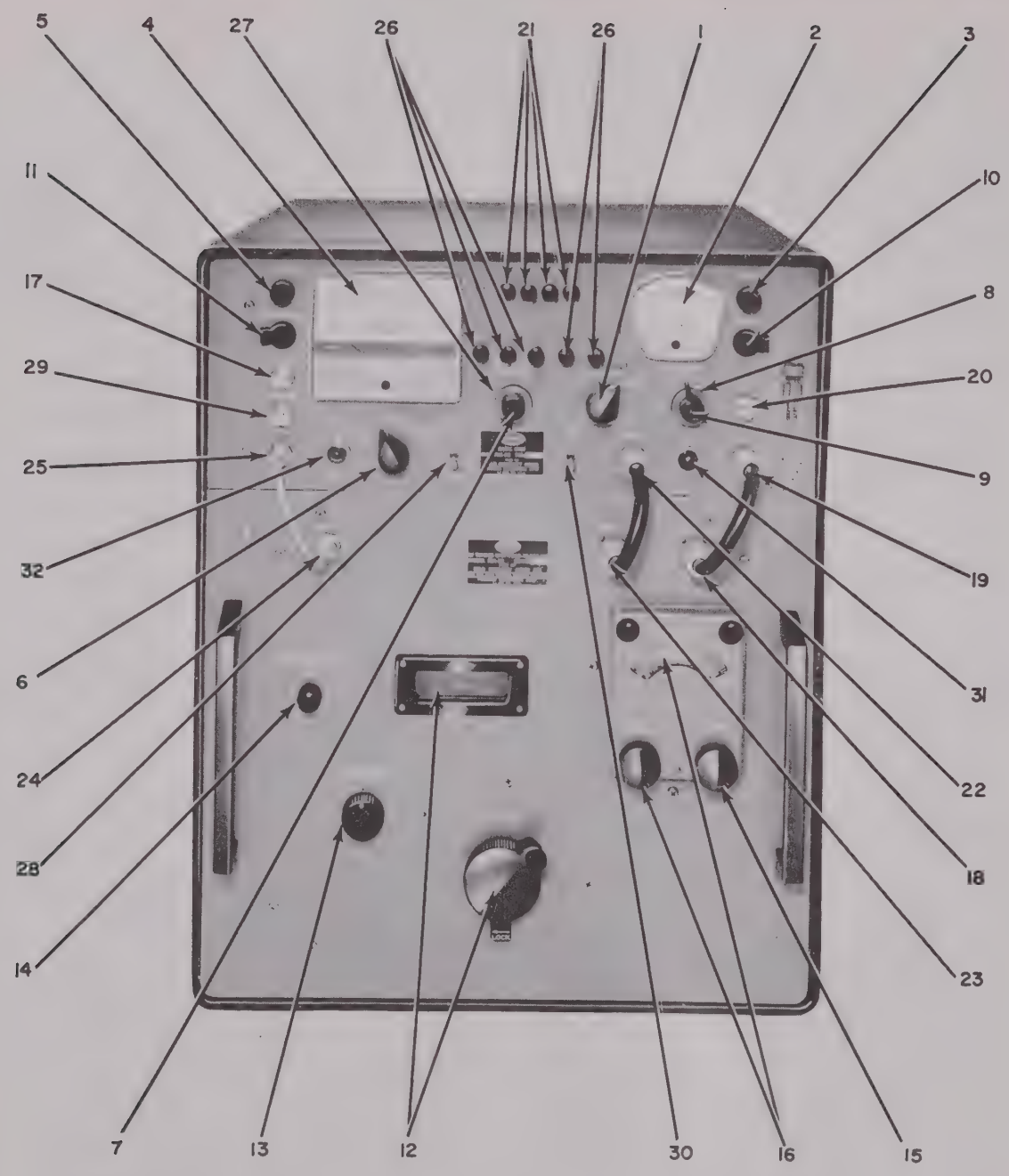


Figure 2-9. Operating Controls, Indicators, and Connectors

TABLE 2-1. OPERATING CONTROLS, INDICATORS, AND CONNECTORS

Front Panel Designation	Figure 2-9 Index No.	Function
FUNCTION SEL switch	1	Selects operating function of the system, as follows: a. ZERO SET - permits zero-setting of power monitor meter b. CAL SIG GEN - FIM-2 operates as a calibrator for the microwave receiver or as a standard signal generator c. OPERATE - FIM-2 operates as a sensitive microwave receiver
Power monitor meter	2	Monitors the signal calibrator power level and the operating voltages and currents generated within the FIM-2, as determined by the setting of the Test Selector switch.
Power monitor meter ZERO SET control	3	Zero-sets the power monitor meter.
Output meter	4	Indicates the average, quasi-peak, slideback-peak, or peak value of applied r-f signal.
Output meter ZERO SET control	5	Zero-sets the output meter.
OUTPUT switch	6	Selects measurement to be made, as follows: a. ZERO SET - permits zero-setting of output meter b. AVERAGE - average value of r-f signal is evaluated c. QUASI-PEAK - interference capability (nuisance value) of r-f signal is evaluated d. SLIDEBACK - peak value of

TABLE 2-1. OPERATING CONTROLS, INDICATORS, AND CONNECTORS (cont'd).

Front Panel Designation	Figure 2-9 Index No.	Function
OUTPUT switch (cont'd)		r-f signal evaluated by slideback technique in conjunction with SLIDEBACK control and AUDIO GAIN control e. PEAK - peak value of r-f signal evaluated by direct reading peak voltmeter
SLIDEBACK control	7	Permits evaluation of peak value of r-f signals by slideback technique in conjunction with AUDIO GAIN control.
AUDIO GAIN control	8	Used in conjunction with SLIDEBACK control when evaluating peak value of r-f signal by slideback technique and when monitoring audio-modulated signals.
AURAL AID control and switch	9	Facilitates detection of r-f signal by 1,000-cps modulation of i-f signal.
AUDIO OUT jack	10	Provided for aural monitoring of modulation through external 600-ohm headset.
RECORDER OUT jack	11	Provided for simultaneous recording of output meter indication on external 100-kilohm recorder.
TUNING control and FREQUENCY IN KILO-MEGACYCLES dial	12	Tunes the receiver and signal calibrator to the frequency indicated on the dial (with an accuracy of ±1%).
SIGNAL CALIBRATOR COARSE TUNING control	13	Mechanically trims physical length of signal calibrator external resonant cavity.

TABLE 2-1. OPERATING CONTROLS, INDICATORS, AND CONNECTORS (cont'd)

Front Panel Designation	Figure 2-9 Index No.	Function
SIGNAL CALIBRATOR FINE TUNING control	14	Electrically centers operating mode of signal calibrator reflex klystron.
SIGNAL CALIBRATOR POWER SET control	15	Sets output level of signal calibrator at 0 dbm (±1 db with the use of the correction curves supplied with the Tuning Unit in use).
SIGNAL CALIBRATOR OUTPUT ATTENUATOR control and -DBM MICROVOLTS dial	16	Varies r-f output of signal calibrator from 0 to -95 dbm (0.223 volts rms to 5 microvolts) with an accuracy of ±1 db, as indicated on the dial.
EXT MOD jack	17	Provided for external 1,000-cps square-wave modulation of signal calibrator.
SIG GEN OUT jack	18	Front panel connector at which output of signal calibrator is available.
CAL IN jack	19	Front panel connector which couples output of signal calibrator to receiver r-f input attenuators.
RF IN jack	20	Front panel connector which couples output of calibrated antenna to receiver r-f input attenuators
R-f INPUT ATTENUATOR DB push-button switches	21	Inserts r-f attenuation in 20-db steps from 0 to 60 db.
ATTEN OUT jack	22	Front panel connector at which output of r-f attenuators is available.

TABLE 2-1. OPERATING CONTROLS, INDICATORS, AND CONNECTORS (cont'd).

Front Panel Designation	Figure 2-9 Index No.	Function
PRESEL IN jack	23	Front panel connector which couples r-f signal under measurement to preselector.
MIXER OUT jack	24	Front panel connector at which the first i-f signal is available.
IF IN jack	25	Front panel connector which couples first i-f signal to preamplifier.
I-f Input Attenuator Db push-button switches	26	Inserts i-f attenuation in 1-db steps from 0 to 20 db.
IF GAIN control	27	Adjusts overall gain of receiver and is used when calibrating the system.
AFC switch	28	Compensates for incoming signal frequency drift when in the IN position.
VIDEO OUT jack	29	Front panel connector for use with an external oscilloscope when monitoring modulation components.
POWER switch	30	Energizes the FIM-2.
POWER pilot lamp	31	Indicates FIM-2 is energized.
KLY pilot lamp	32	Indicates high-voltage power supply is energized.

2-7. OPERATING CHECKS.

2-8. The operating checks outlined below serve a dual purpose; they serve to determine if the newly arrived system operates properly, and to familiarize the operator with the functions of the operating controls, indicators, and connectors. If any step listed below cannot be successfully completed, the FIM-2 is not functioning properly and reference should be made to the maintenance and/or alignment procedures contained in section IV.

a. Remove the Model FIM-S2 Tuning Unit from its storage container and insert the Tuning Unit into the Basic Unit. (If the FIM-S2 has not been procured, use that Tuning Unit available. The operating checks, however, should be modified to incorporate signal frequencies that are compatible with the Tuning Unit used.)

CAUTION:

DO NOT INSERT A TUNING UNIT INTO (OR REMOVE A TUNING UNIT FROM) THE BASIC UNIT WHEN THE FREQUENCY IN KILO-MEGACYCLES DIAL INDICATES A FREQUENCY OTHER THAN THE HIGH END OF THE BAND.

b. Set the POWER switch to the OFF position.

CAUTION:

THE BASIC UNIT IS FACTORY SET FOR OPERATION FROM A 115-VOLT LINE. IF THE SYSTEM IS TO BE OPERATED FROM A 230-VOLT LINE, BE SURE TO SET THE 115/230V SWITCH, LOCATED AT THE REAR OF THE BASIC UNIT, TO THE 230V POSITION.

c. Connect a nominal 115-volt, 50 to 450-cps single-phase source of power to Power Input receptacle J100, located at the bottom rear of the Basic Unit, via electrical power cable assembly W1201 (and power cable adapter CP1201, if necessary).

d. Set the POWER switch to the ON position. The POWER pilot lamp will immediately light, indicating that line power is being applied to the FIM-2. After a 60-second delay the KLY pilot lamp will light, indicating that the high-voltage power supply is energized. Allow the FIM-2 to warm up for at least 15 minutes.

e. Connect r-f cable assembly W1205 as a jumper between the SIG GEN OUT jack and the CAL IN jack, as shown in figure 2-10.

f. Connect r-f cable assembly W1203 as a jumper between the ATTEN OUT jack and the PRESEL IN jack, as shown in figure 2-10.

g. Connect i-f cable assembly W1204 as a jumper between the MIXER OUT jack and the IF IN jack, as shown in figure 2-10.

h. Depress the r-f INPUT ATTENUATOR DB push-button switch marked 0X1.

i. Adjust the i-f Input Attenuator Db push-button switches so that there is no i-f attenuation inserted into the system (all buttons out).

j. Set the FUNCTION SEL switch to the ZERO SET position.

k. Adjust the power monitor meter ZERO SET control to obtain a power monitor meter pointer indication of ZERO.

l. Set the OUTPUT switch to the ZERO SET position.

m. Adjust the output meter ZERO SET control to zero-set the output meter pointer.

n. Set the AFC switch to the OUT position.

o. Set the FUNCTION SEL switch to the OPERATE position.

p. Set the OUTPUT switch to the AVERAGE position.

q. Adjust the IF GAIN control so that the noise present in the system produces an output meter pointer deflection of 20 on the RF UV scale.

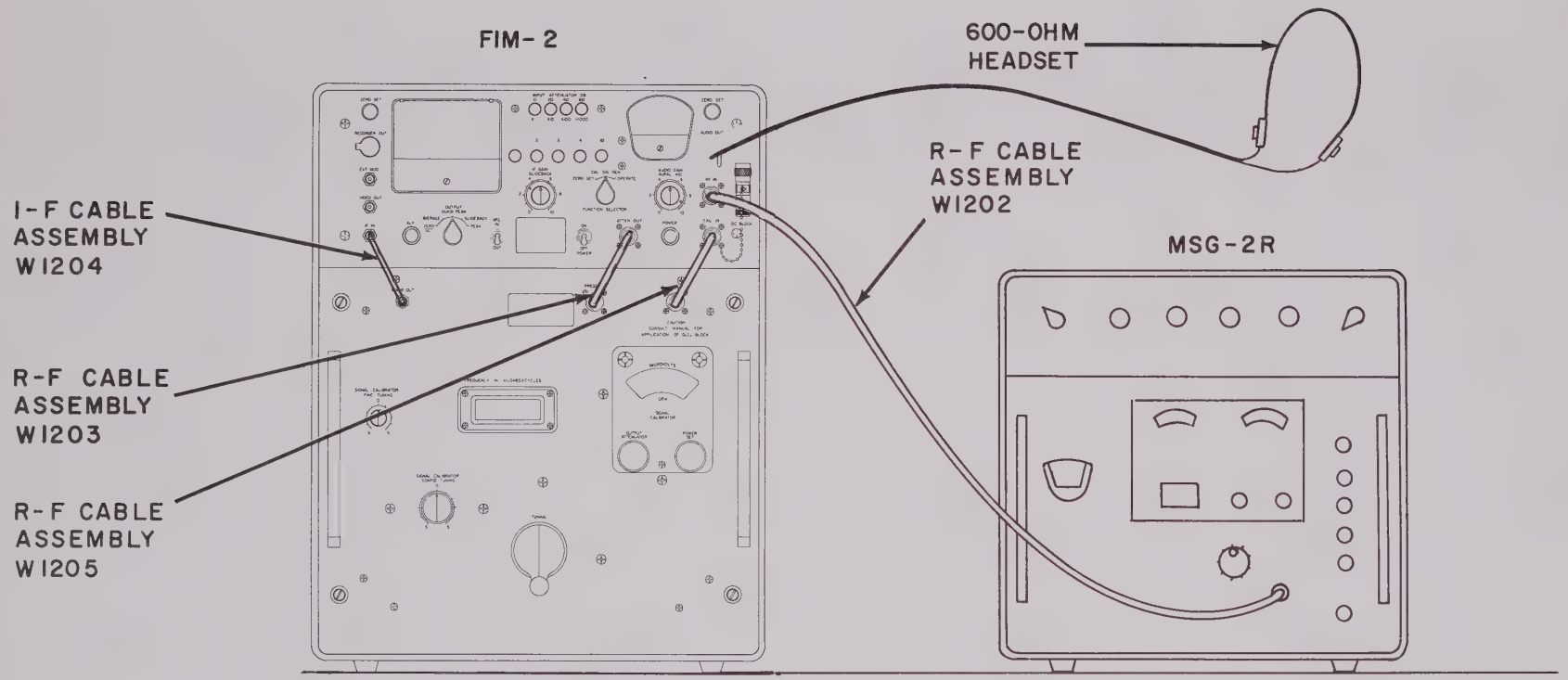


Figure 2-10. Operating Checks, Equipment Set Up

r. Connect r-f cable assembly W1202 between the RF IN jack and the output connector of a calibrated microwave signal generator (such as the Polarad Model MSG-2A or MSG-2R Microwave Signal Generator), as shown in figure 2-10.

s. Adjust the calibrated microwave signal generator for a cw output of 800 microvolts at any frequency within the tuning range of the Model FIM-S2 Tuning Unit.

t. Connect a 600-ohm headset to the AUDIO OUT jack, as shown in figure 2-10.

u. Rotate the AURAL AID control clockwise, beyond its "off" position, to a front panel indication of 5.

v. Rotate the AUDIO GAIN control clockwise to a front panel indication of 5.

w. Rotate the TUNING control throughout the band in search of the r-f signal. When the output meter pointer deflects to an indication of greater than 20 (on the RF UV scale), or when a 1,000-cps aural indication is heard in the headset, the Tuning Unit is tuned to the frequency of the calibrated microwave signal generator. Note the FREQUENCY IN KILOMEGACYCLES dial indication. It should be within ±2% (due to the error imparted by the calibrated microwave signal generator) of that of the MSG-2A or MSG-2R.

x. Rotate the SIGNAL CALIBRATOR OUTPUT ATTENUATOR control fully counterclockwise.

y. Set the FUNCTION SEL switch to CAL SIG GEN.

z. Rotate the SIGNAL CALIBRATOR COARSE TUNING control to a front panel indication of 0.

aa. Rotate the SIGNAL CALIBRATOR FINE TUNING control to a front panel indication of 0.

ab. Adjust the SIGNAL CALIBRATOR POWER SET control to obtain a power monitor meter pointer deflection corresponding to "cal," as indicated on the correction curves supplied with the Model FIM-S2 Tuning Unit.

ac. Adjust the SIGNAL CALIBRATOR OUTPUT ATTENUATOR control to obtain an output meter pointer deflection of approximately 100 on the RF UV scale.

ad. Adjust the SIGNAL CALIBRATOR COARSE TUNING control to obtain maximum deflection of the output meter pointer.

ae. Adjust the SIGNAL CALIBRATOR FINE TUNING control to peak the deflection of the output meter pointer.

af. Readjust the SIGNAL CALIBRATOR POWER SET control, if necessary, to maintain a power monitor meter pointer deflection corresponding to "cal."

ag. Rotate the IF GAIN control fully counterclockwise.

ah. Adjust the SIGNAL CALIBRATOR OUTPUT ATTENUATOR control to obtain a -DBM MICROVOLTS dial indication of 1K on the microvolts scale.

ai. Adjust the IF GAIN control to obtain an output meter pointer deflection of 1,000 on the RF UV scale. This calibrates the receiver for 1,000 microvolts full-scale deflection.

aj. Set the FUNCTION SEL switch to the OPERATE position.

ak. Rotate the AURAL AID control fully counterclockwise, to its "off" position.

al. Note the output meter pointer deflection. This indication, when multiplied by the attenuation factor of 1 (since the OX1 r-f INPUT ATTENUATOR DB push-button switch is depressed), is the value of the cw r-f signal under measurement and should be equal to the signal generator output attenuator dial indication within an accuracy of ±2 db due to the error imparted by the signal generator (i.e., 800 microvolts $^{+208 \text{ microvolts}}_{-145 \text{ microvolts}}$).

am. Set the OUTPUT switch to the QUASI-PEAK position.

an. Note the output meter pointer deflection. It should be the same as that of steps al, above.

ao. Set the OUTPUT switch to the SLIDEBACK position.

ap. Rotate the SLIDEBACK control fully counterclockwise.

aq. Rotate the AURAL AID control clockwise, beyond its "off" position, to obtain a comfortable aural indication from the headset.

ar. Rotate the SLIDEBACK control slowly clockwise, causing the strength of the aural indication to decrease. As the signal approaches inaudibility, rotate both the AURAL AID and AUDIO GAIN controls further clockwise. Continue rotating the SLIDEBACK control clockwise until the aural indication just vanishes.

as. Note the output meter pointer deflection. It should be the same as that of step al, above .

at. Set the OUTPUT switch to the PEAK position.

au. Note the output meter pointer deflection. It should be the same as that of step al, above.

2-9. MEASURING THE AVERAGE VALUE OF R-F SIGNALS.

2-10. The AVERAGE position of the OUTPUT switch is used to evaluate the average value of a narrowband signal (i.e., cw or audio-modulated cw). The output meter will indicate the value of a signal whose peak level is equal to the average value of the narrowband signal under measurement.

2-11. Two methods are available for the measurement of the average value of r-f signals; both apply when the OUTPUT switch is in the AVERAGE position. The first method, the full-scale calibration technique, is described in paragraph 2-12. The second method, the r-f substitution technique, is described in paragraph 2-13.

2-12. FULL-SCALE CALIBRATION TECHNIQUE. To determine the average value of an r-f signal by the full-scale calibration technique, proceed as outlined in the following steps.

a. Apply operating power to the FIM-2 as outlined in paragraph 2-7, steps b through d.

b. Connect r-f cable assembly W1205 as a jumper between the SIG GEN OUT jack and the CAL IN jack, as shown in figure 2-11.

c. Connect r-f cable assembly W1203 as a jumper between the ATTEN OUT jack and the PRESEL IN jack, as shown in figure 2-11.

d. Connect i-f cable assembly W1204 as a jumper between the MIXER OUT jack and the IF IN jack, as shown in figure 2-11.

e. Depress the r-f INPUT ATTENUATOR DB push-button switch marked 60X1000.

f. Adjust the i-f Input Attenuator Db push-button switches so that there is 20-db of i-f attenuation inserted into the system.

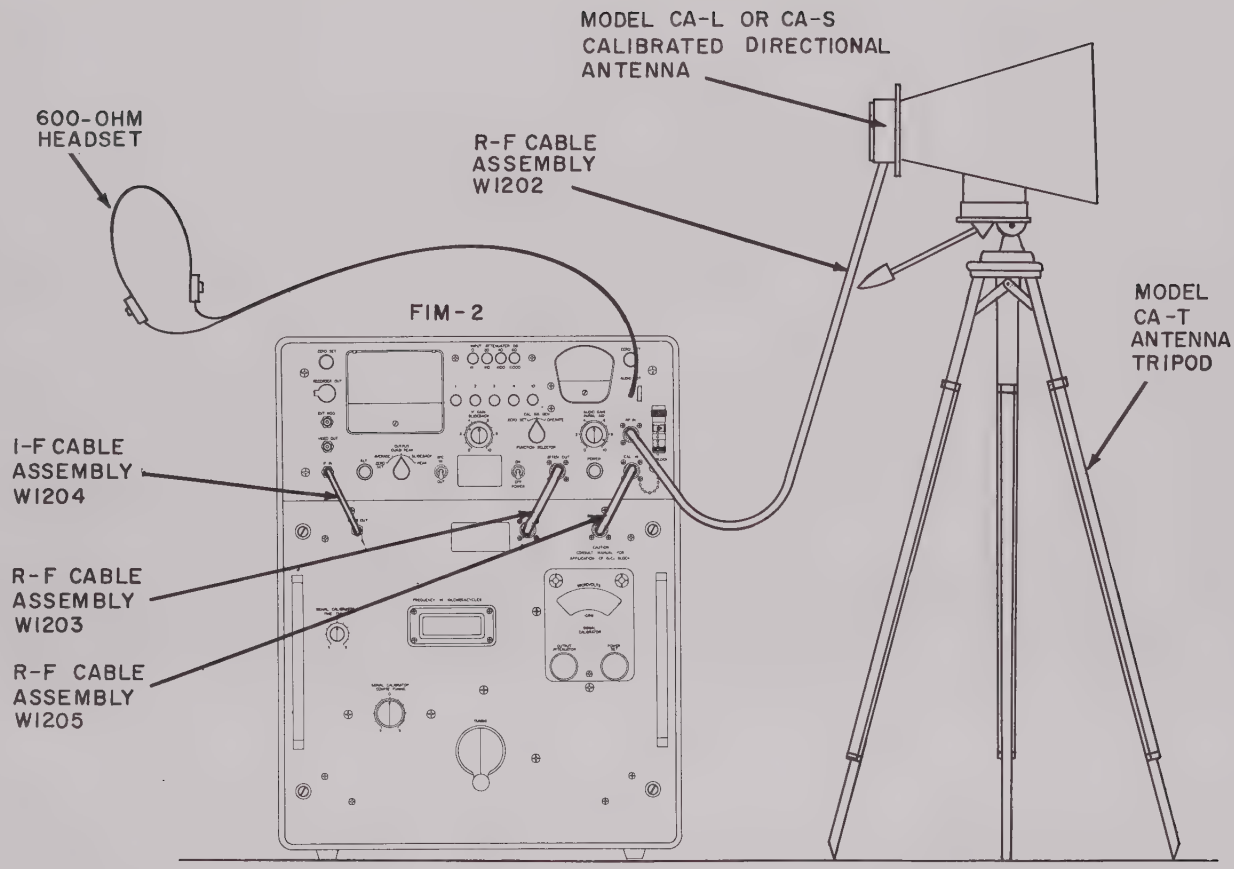


Figure 2-11. Field Intensity Measurements, Equipment Set Up

g. Set the FUNCTION SEL switch to the ZERO SET position.

h. Adjust the power monitor meter ZERO SET control to obtain a power monitor meter pointer indication of ZERO.

i. Set the OUTPUT switch to the ZERO SET position.

j. Adjust the output meter ZERO SET control to zero-set the output meter pointer.

k. Set the AFC switch to the OUT position.

l. Set the FUNCTION SEL switch to the OPERATE position.

m. Set the OUTPUT switch to the AVERAGE position.

n. Adjust the IF GAIN control to obtain an output meter pointer deflection of 20 on the RF UV scale.

o. Connect r-f cable assembly W1202 between the RF IN jack and the output connector of the calibrated antenna corresponding to the Tuning Unit in use, as shown in figure 2-11.

NOTE:

When the Model FIM-M2 or Model FIM-X2 Tuning Unit is being used, connect r-f cable assembly W1202 between the RF IN jack and the bulkhead connector on the Model CA-R Parabolic Reflector. Be sure to connect the additional short length of r-f cable (attached to the other termination of the bulkhead connector) to the output connector of the Model CA-M or Model CA-X Calibrated Feed Horn, respectively.

p. Connect a 600-ohm headset to the AUDIO OUT jack, as shown in figure 2-11.

q. Rotate the AURAL AID control clockwise, beyond its "off" position, to an indication of 5.

r. Rotate the AUDIO GAIN control clockwise to an indication of 5.

s. Rotate the TUNING control throughout the band in search of the r-f signal. When the output meter pointer deflects to an indication greater than 20 on the RF UV scale, or when the 1,000-cps aural indication is heard in the headset, the Tuning Unit is tuned to the frequency of the incoming r-f signal. In the event that neither the output meter nor the headset indicates the presence of an r-f signal, adjust the input attenuation in the sequence listed in table 2-2, below. After each successive adjustment, rotate the TUNING control throughout the band in search of the r-f signal.

TABLE 2-2. SEQUENCE OF INPUT ATTENUATION REMOVAL WHEN SEARCHING FOR INCOMING R-F SIGNAL.

Step	R-f INPUT ATTENUATOR DB Push-button Depressed	R-f Attenuation Inserted	I-f Input Attenuator DB Push-button Depressed	I-f Attenuation Inserted
1	60X1000	60 db	10	10 db
2	40X100	40 db	All	20 db
3	40X100	40 db	10	10 db
4	20X10	20 db	All	20 db
5	20X10	20 db	10	10 db
6	0X1	0 db	All	20 db
7	0X1	0 db	10	10 db
8	0X1	0 db	None	0 db

CAUTION:

THE MAXIMUM R-F INPUT VOLTAGE TO THE FIM-2 IS 3 VOLTS RMS. UNDER NO CIRCUMSTANCES, THEREFORE, SHOULD THE OUTPUT METER POINTER DEFLECT TO AN INDICATION GREATER THAN 300 ON THE RF UV SCALE (CORRESPONDING TO 50 ON THE DB ABOVE 1 UV SCALE AND 35 ON THE DB ABOVE 1 UV/MC SCALE) WHEN 60 DB OF R-F ATTENUATION AND 20 DB OF I-F ATTENUATION IS INSERTED INTO THE SYSTEM.

t. Rotate the SIGNAL CALIBRATOR OUTPUT ATTENUATOR control fully counterclockwise.

u. Set the FUNCTION SEL switch to the CAL SIG GEN position.

v. Rotate the SIGNAL CALIBRATOR COARSE TUNING control to an indication of 0.

w. Rotate the SIGNAL CALIBRATOR FINE TUNING control to an indication of 0.

x. Adjust the SIGNAL CALIBRATOR POWER SET control to obtain a power monitor meter pointer deflection corresponding to "cal," as indicated on the correction curves supplied with the Tuning Unit in use.

y. Depress the r-f INPUT ATTENUATOR DB push-button switch marked 0X1.

z. Adjust the i-f Input Attenuator Db push-button switches so that there is no i-f attenuation inserted into the system.

aa. Adjust the SIGNAL CALIBRATOR OUTPUT ATTENUATOR control to obtain an output meter pointer deflection of 100 on the RF UV scale.

ab. Adjust the SIGNAL CALIBRATOR COARSE TUNING control to obtain maximum deflection of the output meter pointer.

ac. Adjust the SIGNAL CALIBRATOR FINE TUNING control to peak the deflection of the output meter pointer.

ad. Readjust the SIGNAL CALIBRATOR POWER SET control, if necessary, to maintain a power monitor meter pointer deflection corresponding to "cal."

ae. Rotate the AURAL AID control fully counterclockwise to its "off" position.

af. Rotate the IF GAIN control fully counterclockwise.

ag. Adjust the SIGNAL CALIBRATOR OUTPUT ATTENUATOR control to obtain a -DBM MICROVOLTS dial indication of 1K on the microvolts scale.

ah. Adjust the IF GAIN control to obtain an output meter pointer deflection of 1,000 on the RF UV scale.

ai. Depress that combination of input attenuator push-buttons which permitted the first indication of the reception of an r-f signal as indicated by the output meter (see step s, above).

aj. Set the FUNCTION SEL switch to the OPERATE position.

ak. Note the output meter pointer deflection. This corresponds to the value of a cw signal whose peak level is the same as the average value of the narrowband r-f signal under measurement. To determine the numerical value of this indication, use the conversion charts supplied in tables 2-3, 2-4, and 2-5. These charts employ the input attenuation as a parameter.

2-13. DIRECT R-F SUBSTITUTION TECHNIQUE. To determine the average value of a narrowband r-f signal by the direct r-f substitution technique, proceed as outlined in paragraph 2-12, steps a through ai. Then proceed as outlined in the following additional steps.

NOTE:

The direct r-f substitution technique is applicable only when the narrowband r-f signal level is less than or equal to the maximum output level of the signal calibrator (0 dbm).

a. Set the FUNCTION SEL switch to OPERATE.

b. Adjust the IF GAIN control to position the output meter pointer directly over the nearest reference mark on the DB ABOVE 1 UV scale.

c. Set the FUNCTION SEL switch to CAL SIG GEN.

d. Adjust the SIGNAL CALIBRATOR OUTPUT ATTENUATOR control to obtain the same reading as in step b, above.

e. Note the -DBM MICROVOLTS dial indication on the microvolts scale. This indication is the value of a cw signal whose peak level has the same average value as the narrowband signal under measurement.

2-13A. MODIFIED R-F SUBSTITUTION TECHNIQUE. To determine the average value of narrowband r-f signals by the modified r-f substitution technique, proceed as outlined in paragraph 2-12, steps a through ai. Then proceed as outlined in the following additional steps.

NOTE:

The modified r-f substitution technique is applicable for measurement of narrowband r-f signals between the levels of 0 dbm (the maximum output level of the signal calibrator) and 3 volts (the maximum r-f input level for the FIM-2 determined by power dissipation considerations).

a. Set the FUNCTION SEL switch to CAL SIG GEN.

b. Adjust the SIGNAL CALIBRATOR OUTPUT ATTENUATOR control to obtain the same output meter pointer deflection as in paragraph 2-12, step s.

TABLE 2-3. OUTPUT METER RF μV SCALE CONVERSION CHART.

Output Meter RF μV Scale Indication	RMS VALUE OF CW SIGNAL WHICH PRODUCES THE SAME OUTPUT METER POINTER DEFLECTION																							
	60 Db R-f Attenuation 20 Db I-f Attenuation			60 Db R-f Attenuation 10 Db I-f Attenuation			60 Db R-f Attenuation 0 Db I-f Attenuation			40 Db R-f Attenuation 10 Db I-f Attenuation			40 Db R-f Attenuation 0 Db I-f Attenuation			20 Db R-f Attenuation 10 Db I-f Attenuation			20 Db R-f Attenuation 0 Db I-f Attenuation			0 Db R-f Attenuation 10 Db I-f Attenuation			0 Db R-f Attenuation 0 Db I-f Attenuation		
	μV	Db Above 1μV	Dbm	μV	Db Above 1μV	Dbm	μV	Db Above 1μV	Dbm	μV	Db Above 1μV	Dbm	μV	Db Above 1μV	Dbm	μV	Db Above 1μV	Dbm	μV	Db Above 1μV	Dbm	μV	Db Above 1μV	Dbm	μV	Db Above 1μV	Dbm
10	100 K	100.0	-7.0	31.7 K	90.0	-17.0	10 K	80.0	-27.0	3.17 K	70.0	-37.0	1 K	60.0	-47.0	317	50.0	-57.0	100	40.0	-67.0	31.7	30.0	-77.0	10	20.0	-87.0
20	200 K	106.0	-1.0	63.4 K	96.0	-11.0	20 K	86.0	-21.0	6.34 K	76.0	-31.0	2 K	66.0	-41.0	634	56.0	-51.0	200	46.0	-61.0	63.4	36.0	-71.0	20	26.0	-81.0
30	300 K	109.5	+2.5	95.1 K	99.5	-7.5	30 K	89.5	-17.5	9.51 K	79.5	-27.5	3 K	69.5	-37.5	951	59.5	-47.5	300	49.5	-57.5	95.1	39.5	-67.5	30	29.5	-77.5
40	400 K	112.0	+5.0	127 K	102.0	-5.0	40 K	92.0	-15.0	12.7 K	82.0	-25.0	4 K	72.0	-35.0	1.27 K	62.0	-45.0	400	52.0	-55.0	127	42.0	-65.0	40	32.0	-75.0
50	500 K	114.0	+7.0	159 K	104.0	-3.0	50 K	94.0	-13.0	15.9 K	84.0	-23.0	5 K	74.0	-33.0	1.59 K	64.0	-43.0	500	54.0	-53.0	159	44.0	-63.0	50	34.0	-73.0
60	600 K	115.5	+8.5	190 K	105.5	-1.5	60 K	95.5	-11.5	19.0 K	85.5	-21.5	6 K	75.5	-31.5	1.90 K	65.5	-41.5	600	55.5	-51.5	190	45.5	-61.5	60	35.5	-71.5
70	700 K	116.9	+9.9	222 K	106.9	-0.1	70 K	96.9	-10.1	22.2 K	86.9	-20.1	7 K	76.9	-30.1	2.22 K	66.9	-40.1	700	56.9	-50.1	222	46.9	-60.1	70	36.9	-70.1
80	800 K	118.0	+11.0	254 K	108.0	+1.0	80 K	98.0	-9.0	25.4 K	88.0	-19.0	8 K	78.0	-29.0	2.54 K	68.0	-39.0	800	58.0	-49.0	254	48.0	-59.0	80	38.0	-69.0
90	900 K	119.1	+12.1	285 K	109.1	+2.1	90 K	99.1	-7.9	28.5 K	89.1	-17.9	9 K	79.1	-27.9	2.85 K	69.1	-37.9	900	59.1	-47.9	285	49.1	-57.9	90	39.1	-67.9
100	1.0 volt	120.0	+13.0	317 K	110.0	+3.0	100 K	100.0	-7.0	31.7 K	90.0	-17.0	10 K	80.0	-27.0	3.17 K	70.0	-37.0	1.0 K	60.0	-47.0	317	50.0	-57.0	100	40.0	-67.0
120	1.2 volts	121.5	+14.5	380 K	111.5	+4.5	120 K	101.5	-5.5	38.0 K	91.5	-15.5	12 K	81.5	-25.5	3.80 K	71.5	-35.5	1.2 K	61.5	-45.5	380	51.5	-55.5	120	41.5	-65.5
140	1.4 volts	122.9	+15.9	444 K	112.9	+5.9	140 K	102.9	-4.1	44.4 K	92.9	-14.1	14 K	82.9	-24.1	4.44 K	72.9	-34.1	1.4 K	62.9	-44.1	444	52.9	-54.1	140	42.9	-64.1
160	1.6 volts	124.0	+17.0	508 K	114.0	+7.0	160 K	104.0	-3.0	50.8 K	94.0	-13.0	16 K	84.0	-23.0	5.08 K	74.0	-33.0	1.6 K	64.0	-43.0	508	54.0	-53.0	160	44.0	-63.0
180	1.8 volts	125.1	+18.1	570 K	115.1	+8.1	180 K	105.1	-1.9	57.0 K	95.1	-11.9	18 K	85.1	-21.9	5.70 K	75.1	-31.9	1.8 K	65.1	-41.9	570	55.1	-51.9	180	45.1	-61.9
200	2 volts	126.0	+19.0	634 K	116.0	+9.0	200 K	106.0	-1.0	63.4 K	96.0	-11.0	20 K	86.0	-21.0	6.34 K	76.0	-31.0	2.0 K	66.0	-41.0	634	56.0	-51.0	200	46.0	-61.0
300	3 volts	129.5	+22.5	951 K	119.5	+12.5	300 K	109.5	+2.5	95.1 K	99.5	-7.5	30 K	89.5	-17.5	9.51 K	79.5	-27.5	3.0 K	69.5	-37.5	951	59.5	-47.5	300	49.5	-57.5
400	4 volts	132.0	+25.0	1.27 volts	122.0	+15.0	400 K	112.0	+5.0	127 K	102.0	-5.0	40 K	92.0	-15.0	12.7 K	82.0	-25.0	4.0 K	72.0	-35.0	1.27 K	62.0	-45.0	400	52.0	-55.0
500	5 volts	134.0	+27.0	1.59 volts	124.0	+17.0	500 K	114.0	+7.0	159 K	104.0	-3.0	50 K	94.0	-13.0	15.9 K	84.0	-23.0	5.0 K	74.0	-33.0	1.59 K	64.0	-43.0	500	54.0	-53.0
600	6 volts	135.5	+28.5	1.90 volts	125.5	+18.5	600 K	115.5	+8.5	190 K	105.5	-1.5	60 K	95.5	-11.5	19.0 K	85.5	-21.5	6.0 K	75.5	-31.5	1.90 K	65.5	-41.5	600	55.5	-51.5
700	7 volts	136.9	+29.9	2.22 volts	126.9	+19.9	700 K	116.9	+9.9	222 K	106.9	-0.1	70 K	96.9	-10.1	22.2 K	86.9	-20.1	7.0 K	76.9	-30.1	2.22 K	66.9	-40.9	700	56.9	-50.9
800	8 volts	138.0	+31.0	2.54 volts	128.0	+21.0	800 K	118.0	+11.0	254 K	108.0	+1.0	80 K	98.0	-9.0	25.4 K	88.0	-19.0	8.0 K	78.0	-29.0	2.54 K	68.0	-39.0	800	58.0	-49.0
900	9 volts	139.1	+32.1	2.85 volts	129.1	+22.1	900 K	119.1	+12.1	285 K	109.1	+2.1	90 K	99.1	-7.9	28.5 K	89.1	-17.9	9.0 K	79.1	-27.9	2.85 K	69.1	-37.9	900	59.1	-47.9
1000	10 volts	140.0	+33.0	3.17 volts	130.0	+23.0	1 volt	120.0	+13.0	317 K	110.0	+3.0	100 K	90.0	-7.0	3.17 K	80.0	-17.0	10 K	70.0	-27.0	3.17 K	70.0	-37.0	1 K	60.0	-47.0

USE OF CONVERSION CHART:

1. Note output meter pointer deflection.
2. Note r-f and i-f attenuation inserted.
3. Follow appropriate row in Output Meter RF μV Scale Indication column to obtain rms value of cw signal which produces the same deflection, as listed in μV, db above 1μV, and dbm in the appropriate attenuation column.

NOTE:
SHADED PORTION OF TABLE DENOTES VALUES OF INPUT SIGNALS BEYOND CAPABILITY OF FIM-2.

TABLE 2-4. OUTPUT METER DB ABOVE 1μV SCALE CONVERSION CHART.

Output Meter DB ABOVE 1μV Scale Indication	RMS VALUE OF CW SIGNAL WHICH PRODUCES THE SAME OUTPUT METER POINTER DEFLECTION.																											
	60 Db R-f Attenuation 20 Db I-f Attenuation			60 Db R-f Attenuation 10 Db I-f Attenuation			60 Db R-f Attenuation 0 Db I-f Attenuation			40 Db R-f Attenuation 10 Db I-f Attenuation			40 Db R-f Attenuation 0 Db I-f Attenuation			20 Db R-f Attenuation 10 Db I-f Attenuation			20 Db R-f Attenuation 0 Db I-f Attenuation			0 Db R-f Attenuation 10 Db I-f Attenuation			0 Db R-f Attenuation 0 Db I-f Attenuation		
	Db Above 1μV	μV	Dbm	Db Above 1μV	μV	Dbm	Db Above 1μV	μV	Dbm	Db Above 1μV	μV	Dbm	Db Above 1μV	μV	Dbm	Db Above 1μV	μV	Dbm	Db Above 1μV	μV	Dbm	Db Above 1μV	μV	Dbm	Db Above 1μV	μV	Dbm
20	100	100 K	−7	90	31.7 K	−17	80	10 K	−27	70	3.17 K	−37	60	1 K	−47	50	317	−57	40	100	−67	30	31.7	−77	20	10.0	−87
21	101	112 K	−6	91	35.5 K	−16	81	11.2 K	−26	71	3.55 K	−36	61	1.12 K	−46	51	355	−56	41	112	−66	31	35.5	−76	21	11.2	−86
22	102	126 K	−5	92	40.0 K	−15	82	12.6 K	−25	72	4.00 K	−35	62	1.26 K	−45	52	400	−55	42	126	−65	32	40.0	−75	22	12.6	−85
23	103	141 K	−4	93	44.6 K	−14	83	14.1 K	−24	73	4.46 K	−34	63	1.41 K	−44	53	446	−54	43	141	−64	33	44.6	−74	23	14.1	−84
24	104	159 K	−3	94	50.1 K	−13	84	15.9 K	−23	74	5.01 K	−33	64	1.59 K	−43	54	501	−53	44	159	−63	34	50.1	−73	24	15.9	−83
25	105	178 K	−2	95	56.2 K	−12	85	17.8 K	−22	75	5.62 K	−32	65	1.78 K	−42	55	562	−52	45	178	−62	35	56.2	−72	25	17.8	−82
26	106	200 K	−1	96	63.1 K	−11	86	20.0 K	−21	76	6.31 K	−31	66	2.00 K	−41	56	631	−51	46	200	−61	36	63.1	−71	26	20.0	−81
27	107	224 K	0	97	71.0 K	−10	87	22.4 K	−20	77	7.10 K	−30	67	2.24 K	−40	57	710	−50	47	224	−60	37	71.0	−70	27	22.4	−80
28	108	252 K	+1	98	80.0 K	−9	88	25.2 K	−19	78	8.00 K	−29	68	2.52 K	−39	58	800	−49	48	252	−59	38	80.0	−69	28	25.2	−79
29	109	282 K	+2	99	89.2 K	−8	89	28.2 K	−18	79	8.92 K	−28	69	2.82 K	−38	59	892	−48	49	282	−58	39	89.2	−68	29	28.2	−78
30	110	317 K	+3	100	100 K	−7	90	31.7 K	−17	80	10.0 K	−27	70	3.17 K	−37	60	1 K	−47	50	317	−57	40	100	−67	30	31.7	−77
31	111	355 K	+4	101	112 K	−6	91	35.5 K	−16	81	11.2 K	−26	71	3.55 K	−36	61	1.12 K	−46	51	355	−56	41	112	−66	31	35.5	−76
32	112	400 K	+5	102	126 K	−5	92	40.0 K	−15	82	12.6 K	−25	72	4.00 K	−35	62	1.26 K	−45	52	400	−55	42	126	−65	32	40.0	−75
33	113	446 K	+6	103	141 K	−4	93	44.6 K	−14	83	14.1 K	−24	73	4.46 K	−34	63	1.41 K	−44	53	446	−54	43	141	−64	33	44.6	−74
34	114	501 K	+7	104	159 K	−3	94	50.1 K	−13	84	15.9 K	−23	74	5.01 K	−33	64	1.59 K	−43	54	501	−53	44	159	−63	34	50.1	−73
35	115	562 K	+8	105	178 K	−2	95	56.2 K	−12	85	17.8 K	−22	75	5.62 K	−32	65	1.78 K	−42	55	562	−52	45	178	−62	35	56.2	−72
36	116	631 K	+9	106	200 K	−1	96	63.1 K	−11	86	20.0 K	−21	76	6.31 K	−31	66	2.00 K	−41	56	631	−51	46	200	−61	36	63.1	−71
37	117	710 K	+10	107	224 K	0	97	71.0 K	−10	87	22.4 K	−20	77	7.10 K	−30	67	2.24 K	−40	57	710	−50	47	224	−60	37	71.0	−70
38	118	800 K	+11	108	252 K	+1	98	80.0 K	−9	88	25.2 K	−19	78	8.00 K	−29	68	2.52 K	−39	58	800	−49	48	252	−59	38	80.0	−69
39	119	892 K	+12	109	282 K	+2	99	89.2 K	−8	89	28.2 K	−18	79	8.92 K	−28	69	2.82 K	−38	59	892	−48	49	282	−58	39	89.2	−68
40	120	1 volt	+13	110	317 K	+3	100	100 K	−7	90	31.7 K	−17	80	10 K	−27	70	3.17 K	−37	60	1 K	−47	50	317	−57	40	100	−67
41	121	1.12 volts	+14	111	355 K	+4	101	112 K	−6	91	35.5 K	−16	81	11.2 K	−26	71	3.55 K	−36	61	1.12 K	−46	51	355	−56	41	112	−66
42	122	1.26 volts	+15	112	400 K	+5	102	126 K	−5	92	40.0 K	−15	82	12.6 K	−25	72	4.00 K	−35	62	1.26 K	−45	52	400	−55	42	126	−65
43	123	1.41 volts	+16	113	446 K	+6	103	141 K	−4	93	44.6 K	−14	83	14.1 K	−24	73	4.46 K	−34	63	1.41 K	−44	53	446	−54	43	141	−64
44	124	1.59 volts	+17	114	501 K	+7	104	159 K	−3	94	50.1 K	−13	84	15.9 K	−23	74	5.01 K	−33	64	1.59 K	−43	54	501	−53	44	159	−63
45	125	1.78 volts	+18	115	562 K	+8	105	178 K	−2	95	56.2 K	−12	85	17.8 K	−22	75	5.62 K	−32	65	1.78 K	−42	55	562	−52	45	178	−62
46	126	2.00 volts	+19	116	631 K	+9	106	200 K	−1	96	63.1 K	−11	86	20.0 K	−21	76	6.31 K	−31	66	2.00 K	−41	56	631	−51	46	200	−61
47	127	2.24 volts	+20	117	710 K	+10	107	224 K	0	97	71.0 K	−10	87	22.4 K	−20	77	7.10 K	−30	67	2.24 K	−40	57	710	−50	47	224	−60
48	128	2.52 volts	+21	118	800 K	+11	108	252 K	+1	98	80.0 K	−9	88	25.2 K	−19	78	8.00 K	−29	68	2.52 K	−39	58	800	−49	48	252	−59
49	129	2.82 volts	+22	119	892 K	+12	109	282 K	+2	99	89.2 K	−8	89	28.2 K	−18	79	8.92 K	−28	69	2.82 K	−38	59	892	−48	49	282	−58
50	130	3.17 volts	+23	120	1 volt	+13	110	317 K	+3	100	100 K	−7	90	31.7 K	−17	80	10 K	−27	70	3.17 K	−37	60	1 K	−47	50	317	−57
51	131	3.55 volts	+24	121	1.12 volts	+14	111	355 K	+4	101	112 K	−6	91	35.5 K	−16	81	11.2 K	−26	71	3.55 K	−36	61	1.12 K	−46	51	355	−56
52	132	4.00 volts	+25	122	1.26 volts	+15	112	400 K	+5	102	126 K	−5	92	40.0 K	−15	82	12.6 K	−25	72	4.00 K	−35	62	1.26 K	−45	52	400	−55
53	133	4.46 volts	+26	123	1.41 volts	+16	113	446 K	+6	103	141 K	−4	93	44.6 K	−14	83	14.1 K	−24	73	4.46 K	−34	63	1.41 K	−44	53	446	−54
54	134	5.01 volts	+27	124	1.59 volts	+17	114	501 K	+7	104	159 K	−3	94	50.1 K	−13	84	15.9 K	−23	74	5.01 K	−33	64	1.59 K	−43	54	501	−53
55	135	5.62 volts	+28	125	1.78 volts	+18	115	562 K	+8	105	178 K	−2	95	56.2 K	−12	85	17.8 K	−22	75	5.62 K	−32	65	1.78 K	−42	55	562	−52
56	136	6.31 volts	+29	126	2.00 volts	+19	116	631 K	+9	106	200 K	−1	96	63.1 K	−11	86	20.0 K	−21	76	6.31 K	−31	66	2.00 K	−41	56	631	−51
57	137	7.10 volts	+30	127	2.24 volts	+20	117	710 K	+10	107	224 K	0	97	71.0 K	−10	87	22.4 K	−20	77	7.10 K	−30	67	2.24 K	−40	57	710	−50
58	138	8.00 volts	+31	128	2.52 volts	+21	118	800 K	+11	108	252 K	+1	98	80.0 K	−9	88	25.2 K	−19	78	8.00 K	−29	68	2.52 K	−39	58	800	−49
59	139	8.92 volts	+32	129	2.82 volts	+22	119	892 K	+12	109	282 K	+2	99	89.2 K	−8	89	28.2 K	−18	79	8.92 K	−28	69	2.82 K	−38	59	892	−48
60	140	10.0 volts	+33	130	3.17 volts	+23	120	1 volt	+13	110	317 K	+3	100	100 K	−7	90	31.7 K	−17	80	10 K	−27	70	3.17 K	−37	60	1 K	−47

USE OF CONVERSION CHART:

1. Note output meter pointer deflection.
2. Note r-f and i-f attenuation inserted.
3. Follow appropriate row in Output Meter DB ABOVE 1μV Scale Indication column to obtain rms value of cw signal which produces the same deflection, as listed in db above 1μV, μv, and dbm in the appropriate attenuation column.

NOTE: SHADED PORTION OF TABLE DENOTES VALUES OF INPUT SIGNALS BEYOND CAPABILITY OF FIM-2.

TABLE 2-5. OUTPUT METER DB ABOV

Output Meter DB ABOVE 1μV/MC Scale Indication	RMS VALUE OF CW SIGNAL WHICH PRODUCE								
	60Db R-f Atten 20Db I-f Atten		60 Db R-f Atten 10 Db I-f Atten		60 Db R-f Atten 0 Db I-f Atten		40 Db R-f Atten 10 Db I-f Atten		40 D 0 D
	DB ABOVE 1μV/MC	μV	DB ABOVE 1μV/MC	μV	DB ABOVE 1μV/MC	μV	DB ABOVE 1μV/MC	μV	DB A 1μV/
5	85	89K	75	28K	65	8.9K	55	2.80K	45
10	90	158K	80	50K	70	15.8K	60	5.00K	5(
15	95	280K	85	89K	75	28.0K	65	8.90K	5
20	100	500K	90	158K	80	50.0K	70	15.8K	6(
25	105	890K	95	280K	85	89.0K	75	28.0K	6
30	110	1.58M	100	500K	90	158K	80	50.0K	7(
35	115	2.8M	105	890K	95	280K	85	89.0K	7
40	120	5.0M	110	1.58M	100	500K	90	158K	8(
45	125	8.9M	115	2.89M	105	890K	95	280K	8

USE OF CONVERSION CHART:

1. Note output meter pointer deflection.
2. Note r-f and i-f attenuation inserted.
3. Follow appropriate row in Output Meter DB ABOVE 1μV/M to obtain rms value of CW signal which produces the sa in db above 1 μv/mc and μV in the appropriate attenu

NOTE:

SHADED PORTION OF TABLE DENOTES VALUES OF INPUT SIGNALS

1μV/MC SCALE CONVERSION CHART.

SAME OUTPUT METER POINTER DEFLECTION								
-f Atten f Atten		20 Db R-f Atten 10 Db 1-f Atten		20 Db R-f Atten 0 Db 1-f Atten		0 Db R-f Atten 10 Db 1-f Atten		0 Db R-f Atten 0 Db 1-f Atten	
μV	DB ABOVE 1μV/MC	μV	DB ABOVE 1μV/MC	μV	DB ABOVE 1μV/MC	μV	DB ABOVE 1μV/MC	μV
890	35	280	25	89	15	28	5	8.9
1.58K	40	500	30	158	20	50	10	15.8
2.80K	45	890	35	280	25	89	15	28.0
5.00K	50	1.58K	40	500	30	158	20	50.0
8.90K	55	2.80K	45	890	35	280	25	89.0
15.8K	60	5.00K	50	1.58K	40	500	30	158
28.0K	65	8.90K	55	2.80K	45	890	35	280
50.0K	70	15.8K	60	5.0K	50	1,580	40	500
89.0K	75	50.0K	65	8.9K	55	2,800	45	890

Scale Indication column
deflection, as listed
in column.

YOND CAPABILITY OF FIM-2.

NOTE:

If the output meter pointer deflection of paragraph 2-12, step s, cannot be obtained, remove r-f attenuation in 20-db steps and repeat step b, above.

c. Note the amount of r-f attenuation removed.

d. Note the -DBM MICROVOLTS dial indication on the -dbm scale.

e. The average value of the narrowband r-f signal under measurement is equal to the -DBM MICROVOLTS dial indication (in -dbm) plus the amount of r-f attenuation removed (in db).

2-14. MEASURING THE QUASI-PEAK VALUE OF R-F SIGNALS.

2-15. The QUASI-PEAK position of the OUTPUT switch is used to determine the nuisance value of an interference. It can be used to detect the presence of either broadband or narrowband r-f signals. The greater the prf of the signal under measurement, the greater the output meter indication (for a given signal amplitude). Further evaluation of the r-f signal can be obtained through the use of the AVERAGE and PEAK positions of the OUTPUT switch.

2-16. To determine the quasi-peak value of r-f signals, proceed as outlined in paragraph 2-12, steps a through ai. Then proceed as outlined in the following steps.

a. Set the OUTPUT switch to the QUASI-PEAK position.

b. Note the output meter pointer deflection. The value of a cw signal whose peak level is the same as the quasi-peak value of the signal under measurement can be obtained with the aid of the conversion charts supplied in tables 2-3, 2-4, and 2-5.

2-16. MEASURING THE PEAK VALUE OF R-F SIGNALS BY THE SLIDEBACK TECHNIQUE.

2-17. The SLIDEBACK position of the OUTPUT switch can be used to determine the peak value of broadband (pulsed) signals by the slideback technique. The output meter indication will be the value of a cw signal whose peak level is equal to that of the r-f signal under measurement.

2-18. To determine the peak value of r-f signals by the slideback technique, proceed as outlined in paragraph 2-12, steps a through al. Then proceed as outlined in the following additional steps.

a. Set the OUTPUT switch to SLIDEBACK.

b. Rotate the SLIDEBACK control fully counterclockwise.

c. Note the aural indication obtained in the headset.

d. Rotate the SLIDEBACK control clockwise, causing the aural indication to decrease in strength. As the signal strength decreases, rotate the AUDIO GAIN control clockwise. Continue rotating the SLIDEBACK control clockwise until the aural indication can no longer be heard in the headset.

e. Note the output meter pointer indication. This is the level of a cw signal having the same peak value as the r-f signal under measurement. See the conversion charts listed in tables 2-3, 2-4, and 2-5.

2-18. MEASURING THE PEAK VALUE OF R-F SIGNALS.

2-19. The PEAK position of the OUTPUT switch, like the SLIDEBACK

position, is used to determine the peak value of either narrowband or broadband signals. The output meter pointer deflection will correspond to the value of a cw signal whose peak level is equal to that of the r-f signal under measurement.

2-19. To determine the peak value of r-f signals, proceed as outlined in paragraph 2-12, steps a through ai. Then proceed as outlined in the following steps.

a. Set the OUTPUT switch to the PEAK position.

b. Note the output meter pointer deflection. The actual value of a cw signal having the same peak level as the signal under measurement can be obtained with the aid of the scale conversion charts supplied in tables 2-3, 2-4, and 2-5.

2-20. MEASURING ATTENUATOR CHARACTERISTICS.

2-21. The three basic methods for measurement of r-f attenuation (i-f substitution method, r-f substitution method, and calibrated signal generator method) are described below in paragraphs 2-22, 2-23, and 2-24, respectively.

2-22. I-F SUBSTITUTION METHOD. To determine the attenuation of an r-f attenuator using the i-f substitution method, proceed as outlined in the following steps.

NOTE:

This method is valid only when the insertion loss of the r-f attenuator under test is less than 20 db.

a. Apply operating power to the FIM-2 as outlined in paragraph 2-7, steps b through d.

b. Connect r-f cable assembly W1205 as a jumper between the SIG GEN OUT jack and the CAL IN jack, as shown in figure 2-12.

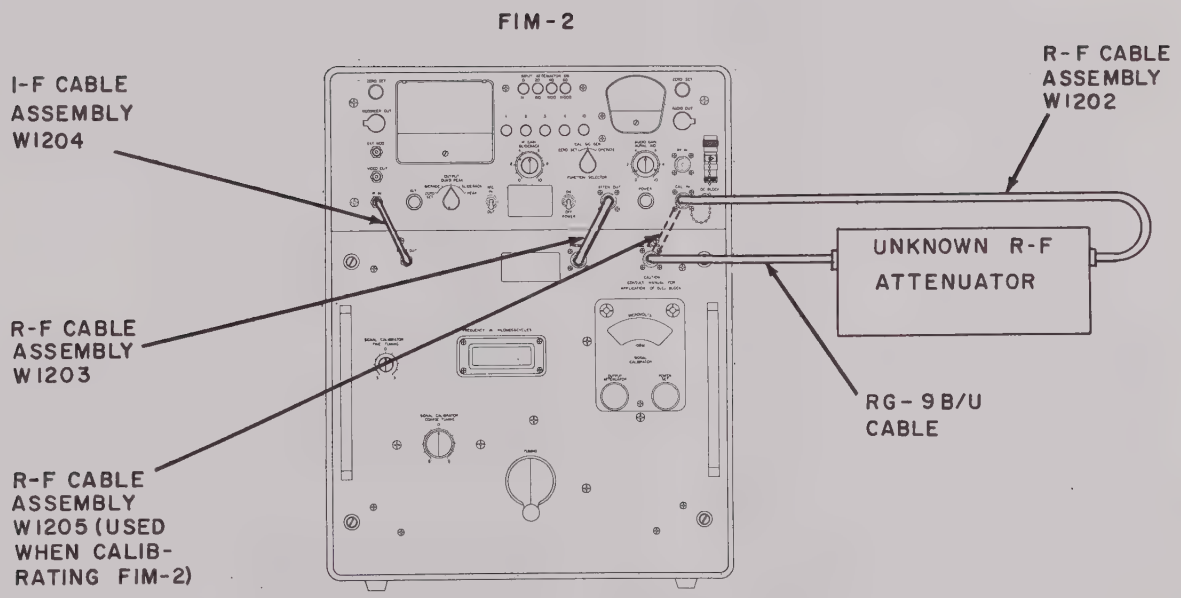


Figure 2-12. Attenuator Measurements Using I-f Substitution Method, Equipment Set Up

c. Connect r-f cable assembly W1203 as a jumper between the ATTEN OUT jack and the PRESEL IN jack, as shown in figure 2-12.

d. Connect i-f cable assembly W1204 as a jumper between the MIXER OUT jack and the IF IN jack, as shown in figure 2-12.

e. Depress the r-f INPUT ATTENUATOR DB push-button switch marked 0X1.

f. Adjust the i-f Input Attenuator Db push-button switches so that there is no i-f attenuation inserted into the system.

g. Set the AFC switch to the OUT position.

h. Rotate the TUNING control to the desired operating frequency, as indicated on the FREQUENCY IN KILOMEGACYCLES dial.

i. Set the FUNCTION SEL switch to the ZERO SET position.

j. Adjust the power monitor meter ZERO SET control to obtain a power monitor meter pointer deflection of ZERO.

k. Set the OUTPUT switch to the ZERO SET position.

l. Adjust the output meter ZERO SET control to zero-set the output meter pointer.

m. Rotate the SIGNAL CALIBRATOR OUTPUT ATTENUATOR control fully counterclockwise.

n. Set the FUNCTION SEL switch to the CAL SIG GEN position.

o. Set the OUTPUT switch to the AVERAGE position.

p. Rotate the SIGNAL CALIBRATOR COARSE TUNING control to an indication of 0.

q. Rotate the SIGNAL CALIBRATOR FINE TUNING control to an indication of 0.

r. Adjust the SIGNAL CALIBRATOR POWER SET control to obtain a power monitor meter pointer deflection corresponding to "cal," as indicated on the correction curves supplied with the Tuning Unit in use.

s. Adjust the SIGNAL CALIBRATOR OUTPUT ATTENUATOR control to obtain an output meter pointer deflection of approximately 100 on the RF UV scale.

t. Adjust the SIGNAL CALIBRATOR COARSE TUNING control to obtain maximum deflection of the output meter pointer.

u. Adjust the SIGNAL CALIBRATOR FINE TUNING control to peak the deflection of the output meter pointer.

v. Readjust the SIGNAL CALIBRATOR POWER SET control, if necessary, to maintain a power monitor meter pointer deflection corresponding to "cal."

w. Rotate the IF GAIN control fully counterclockwise.

x. Adjust the SIGNAL CALIBRATOR OUTPUT ATTENUATOR control to obtain a -DBM MICROVOLTS dial indication of 1K on the microvolts scale.

y. Adjust the IF GAIN control to obtain an output meter pointer deflection of 1000 on the RF UV scale.

z. Interpose the r-f attenuator under test between the SIG GEN OUT jack and the CAL IN jack, as shown in figure 2-12.

aa. Adjust the IF GAIN control to position the output meter pointer directly above the nearest reference mark on the DB ABOVE 1 UV scale. Note this indication.

ab. Remove the r-f attenuator and replace r-f cable assembly W1205 between the SIG GEN OUT jack and the CAL IN jack.

ac. Depress the i-f Input Attenuator Db push-button switches (either individually or in groups) until the reference deflection of step aa, above, is obtained.

ad. The insertion loss, in db, of the r-f attenuator under test is equal to the sum of the panel markings above those i-f Input Attenuator Db push-button switches depressed (within 0.1 db/db).

2-23. R-F SUBSTITUTION METHOD. To determine the insertion loss of an r-f attenuator by the r-f substitution method, proceed as outlined in paragraph 2-22, steps a through y. Then proceed as outlined in the following steps.

NOTE:

This method is valid only when the insertion loss of the r-f attenuator under test is less than 80 db.

a. Interpose the r-f attenuator under test between the SIG GEN OUT jack and the CAL IN jack, as shown in figure 2-13.

b. Adjust the SIGNAL CALIBRATOR OUTPUT ATTENUATOR control to obtain a reference deflection on the output meter DB ABOVE 1 UV scale.

c. Replace the r-f attenuator under test with a calibrated r-f attenuator capable of inserting at least 80 db of attenuation, as shown in figure 2-13. Adjust the calibrated r-f attenuator for maximum insertion loss.

d. Adjust the calibrated r-f attenuator to obtain the output meter deflection of step b, above.

e. The insertion loss of the r-f attenuator under test is equal to that of the calibrated r-f attenuator.

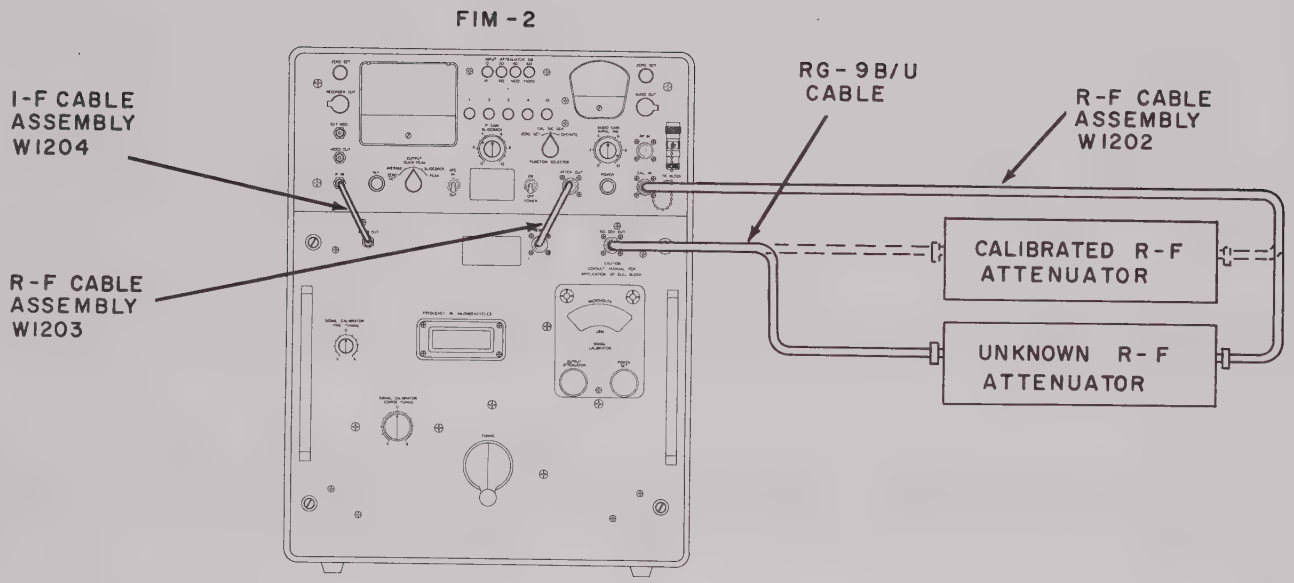


Figure 2-13. Attenuator Measurements Using R-f Substitution Method, Equipment Set Up

2-24. CALIBRATED SIGNAL GENERATOR METHOD. To determine the insertion loss of an r-f attenuator by the calibrated signal generator method, proceed as outlined in paragraph 2-22, steps a through v. Then proceed as outlined in the following steps.

NOTE:

This method is valid only when the insertion loss of the r-f attenuator under measurement is less than 80 db.

a. Interpose the r-f attenuator under test between the SIG GEN OUT jack and the CAL IN jack, as shown in figure 2-12.

b. Adjust the SIGNAL CALIBRATOR OUTPUT ATTENUATOR control to obtain a reference deflection of the output meter pointer at the low end of the DB ABOVE 1 UV scale.

c. Note the -DBM MICROVOLTS dial indication on the -dbm scale.

d. Rotate the SIGNAL CALIBRATOR OUTPUT ATTENUATOR control fully counterclockwise.

e. Remove the r-f attenuator under test and replace r-f cable assembly W1205 between the SIG GEN OUT jack and the CAL IN jack.

f. Adjust the SIGNAL CALIBRATOR OUTPUT ATTENUATOR control to obtain the same output meter pointer deflection as in step b, above.

g. Note the -DBM MICROVOLTS dial indication on the -dbm scale.

h. The attenuation, in db, of the r-f attenuator under test is equal to the difference between the -DBM MICROVOLTS dial indications.

2-25. GAIN CHARACTERISTICS.

2-26. To determine the small-signal gain characteristics of microwave devices, such as a traveling wave tube amplifier, proceed as outlined in paragraph 2-22, steps a through y. Then proceed as outlined in the following steps.

a. Adjust the SIGNAL CALIBRATOR OUTPUT ATTENUATOR control to obtain a -DBM MICROVOLTS dial indication of 50 on the microvolts scale.

b. Connect the input of the microwave device to the SIG GEN OUT jack, as shown in figure 2-14.

c. Connect the output of the microwave device to the CAL IN jack, as shown in figure 2-14.

d. Depress the r-f INPUT ATTENUATOR DB push-button switch marked 60X1000.

e. Note the output meter pointer deflection. If there is no indication, depress the next lower r-f INPUT ATTENUATOR DB push-button switch until an on-scale deflection is obtained. Note this deflection.

f. Remove the microwave device from between the SIG GEN OUT jack and the CAL IN jack and replace r-f cable assembly W1205.

g. Adjust the SIGNAL CALIBRATOR OUTPUT ATTENUATOR control to obtain the same output meter pointer deflection an in step e, above.

h. Note the -DBM MICROVOLTS dial indication on the microvolts scale.

i. The gain of the microwave device, in db, is equal to

$$A = 20 \log_{10} \frac{\text{Reading of step h (in microvolts)}}{\text{50 microvolts}}$$

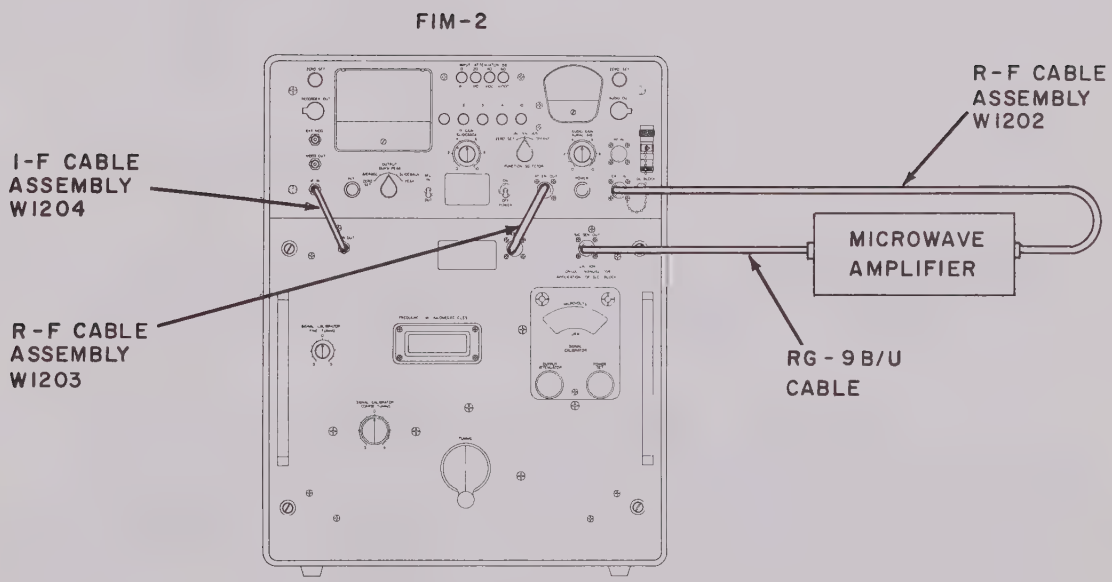


Figure 2-14. Gain Measurements, Equipment Set Up

2-27. VSWR MEASUREMENTS.

2-28. Two methods are available to determine the VSWR of microwave components: one employs the receiver section of the FIM-2; the other employs an external standing wave indicator. The procedures for determining the VSWR of a microwave component using the receiver section of the FIM-2 is outlined in paragraph 2-28A; that using the external standing wave indicator is outlined in paragraph 2-28B.

2-28A. To determine the VSWR of a microwave component using the receiver section of the FIM-2, proceed as outlined in paragraph 2-22, steps a through y. Then proceed as outlined in the following additional steps.

NOTE:

The slotted line referred to in the following steps is of the type that does not contain its own crystal detector.

a. Connect the input of the slotted line to the SIG GEN OUT jack, as shown in figure 2-15.

b. Connect the output of the slotted line to the microwave component under test, as shown in figure 2-15.

c. Connect the slotted line probe output to the CAL IN jack, as shown in figure 2-15.

d. Set the OUTPUT switch to PEAK.

e. Adjust the SIGNAL CALIBRATOR OUTPUT ATTENUATOR control to obtain any desired power level, as indicated on the -DBM MICROVOLTS dial.

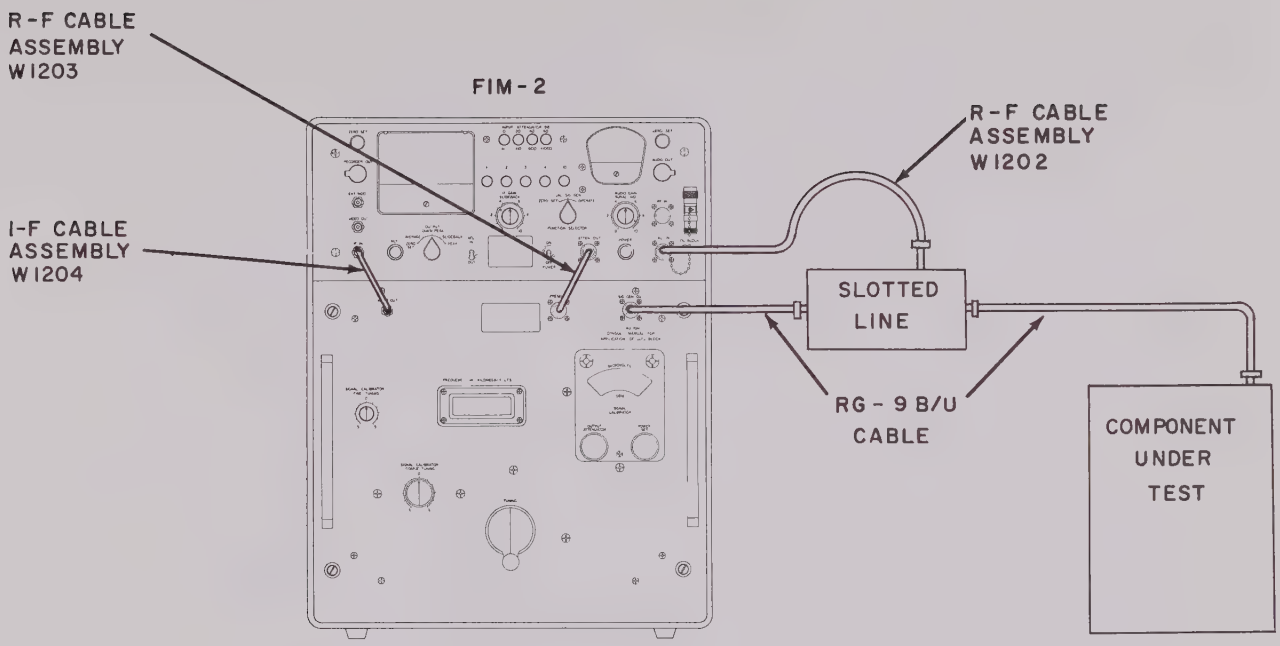


Figure 2-15. VSWR Measurements Using Receiver Section of FIM-2, Equipment Set Up

f. Move the probe along the slotted line until the output meter pointer deflects to a maximum indication.

NOTE:

If the output meter pointer deflects to an off-scale indication, depress the r-f INPUT ATTENUATOR DB push-button switches, in proper sequence, until an on-scale indication is obtained.

g. Note the output meter reading on the DB ABOVE 1 UV scale. Convert this reading to db above one microvolt using the scale conversion chart supplied in table 2-4.

h. Move the probe along the slotted line until the output meter pointer indicates minimum deflection.

i. Note the output meter reading on the DB ABOVE 1 UV scale. Convert this reading to db above one microvolt using the scale conversion chart supplied in table 2-4.

j. The VSWR of the microwave component under test is equal to the difference between the converted readings of steps g and i, and is expressed in db.

2-28B. To determine the VSWR of a microwave component using a standing wave indicator, proceed as outlined in paragraph 2-22, steps a through v. Then proceed as outlined in the following additional steps.

a. Connect a square-wave generator to the EXT MOD jack, as shown in figure 2-15A.

b. Adjust the square-wave generator for a 1,000-cps output at 50 volts peak (100 volts peak-to-peak).

NOTE:

The slotted line referred to in the following steps is of the type that contains its own crystal detector.

c. Connect the input of the slotted line to the SIG GEN OUT jack, as shown in figure 2-15A.

d. Connect the output of the slotted line to the microwave component under test, as shown in figure 2-15A.

e. Connect the slotted line probe output to the input connector of the standing wave indicator, as shown in figure 2-15A.

f. Set the FUNCTION SEL switch to CAL SIG GEN. (For Model FIM-B2 Basic Unit serial numbers 291, 294, 297, 298, 307 to 312, 315, 316, 321, and 322, set the FUNCTION SEL switch to ZERO SET.)

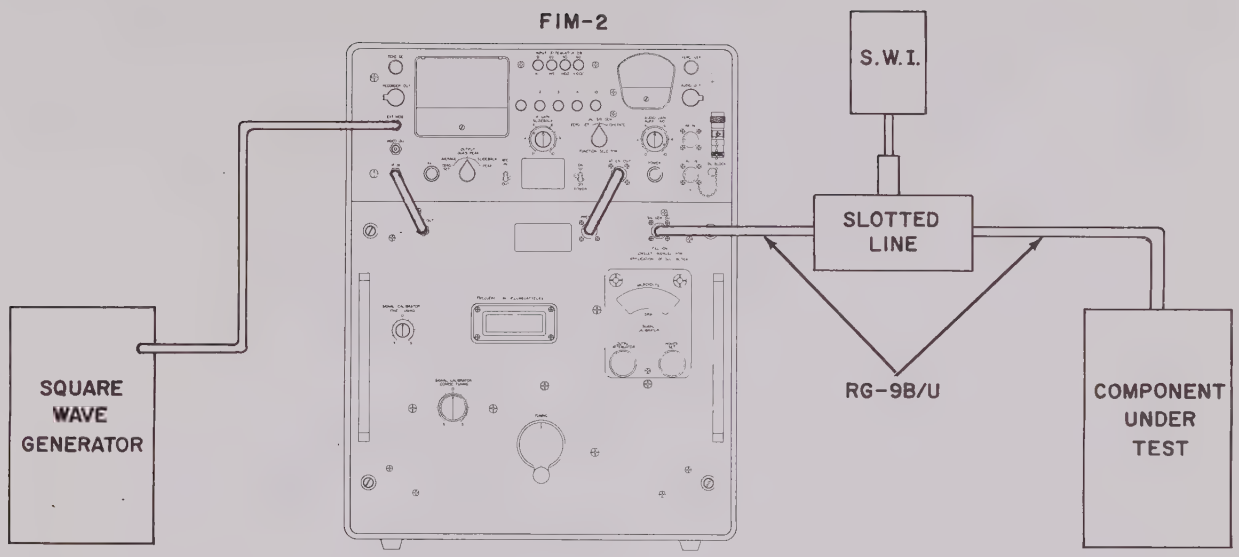


Figure 2-15A. VSWR Measurements Using an External Standing Wave Indicator, Equipment Set Up

g. Adjust the SIGNAL CALIBRATOR OUTPUT ATTENUATOR control to obtain any desired power level, as indicated on the -DBM MICRO-VOLTS dial.

h. Move the probe along the slotted line until the standing wave indicator pointer deflects to a maximum indication.

i. Adjust the standing wave indicator so that the pointer deflects to a full-scale indication.

j. Move the probe along the slotted line until the standing wave indicator pointer deflects to a minimum indication.

k. The VSWR of the microwave component under test, in db, is equal to the standing wave indicator pointer indication of step j.

2-29. MICROWAVE FILTER CHARACTERISTICS.

2-30. To determine the insertion loss versus frequency characteristics of microwave filters, use the procedure for measuring the insertion loss of r-f attenuators using the calibrated signal generator method (see paragraph 2-24). Skirt selectivity can be measured up to 80 db below the center frequency response.

2-31. Q AND BANDWIDTH OF MICROWAVE CAVITIES.

2-32. To determine the Q and bandwidth of medium to low Q microwave cavities, proceed as outlined in paragraph 2-22, steps a through y, with the TUNING control adjusted so that the center frequency of the cavity under test is indicated on the FREQUENCY IN KILOMEGACYCLES dial. Then proceed as outlined in the following steps.

a. Depress the r-f INPUT ATTENUATOR DB push-button switch marked 40X100.

b. Adjust the SIGNAL CALIBRATOR OUTPUT ATTENUATOR control to obtain an output meter pointer deflection of 1,000 on the RF UV scale.

c. Interpose the cavity under test between the SIG GEN OUT jack and the CAL IN jack, as shown in figure 2-16.

d. Note the deflection of the output meter pointer. Determine the corresponding power level of this indication (see tables 2-3, 2-4, and 2-5).

e. Adjust the TUNING control to obtain a FREQUENCY IN KILOMEGACYCLES dial indication which is a small frequency increment away from the cavity center frequency.

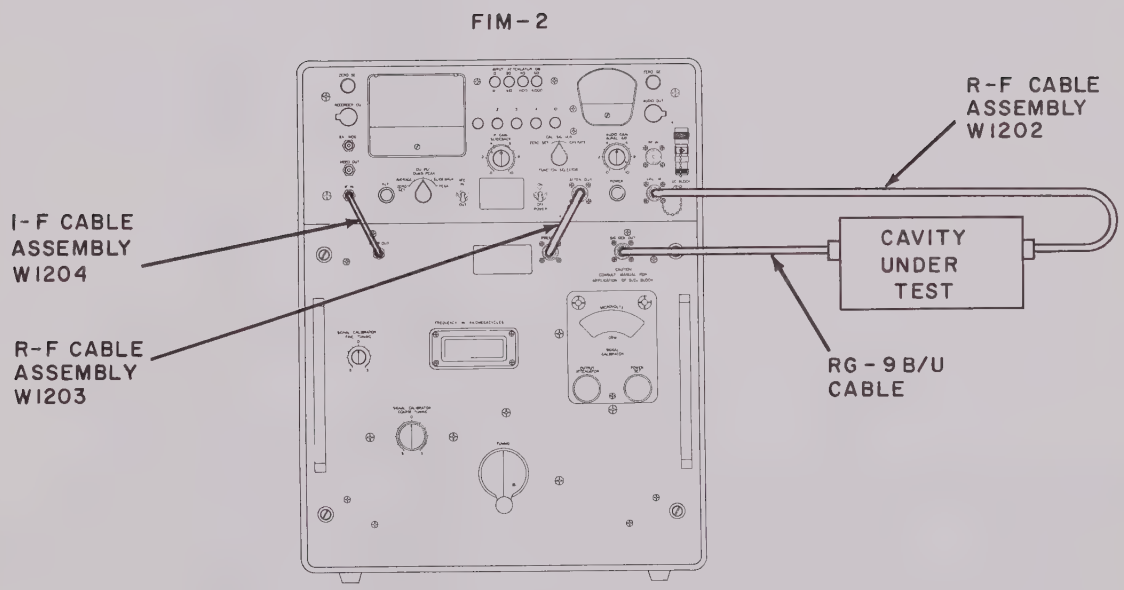


Figure 2-16. Q and Bandwidth Measurements, Equipment Set Up

f. Repeat steps a through y of paragraph 2-22, adjusting the TUNING control to obtain a small frequency displacement from the cavity center frequency.

g. Depress the r-f INPUT ATTENUATOR DB push-button switch marked 40X100.

h. Adjust the SIGNAL CALIBRATOR OUTPUT ATTENUATOR control to obtain an output meter pointer deflection of 1,000 on the RF UV scale.

i. Interpose the cavity under test between the SIG GEN OUT jack and the CAL IN jack, as shown in figure 2-16.

j. Note the deflection of the output meter pointer. Determine the corresponding power level of this indication (see tables 2-4, 2-4, and 2-5).

k. The power response, with respect to the center frequency response, is equal to the difference in power levels between the indications obtained in steps d and j, above.

l. Continue the procedure of steps f through k for further frequency increments, both above and below the center frequency of the cavity, until enough points have been obtained to plot an attenuation versus frequency curve. The bandwidth of the cavity under test can then be determined by finding the points where the power response is 3-db down from the center frequency response. The approximate Q of the cavity can then be determined by the formula

$$Q = \frac{f_o}{\Delta f}$$

where f_o is the center frequency at which the test was conducted and Δf is the 3-db bandwidth of the cavity under test. The highest Q that can be measured with maximum accuracy is

$$Q \leqq \frac{f_o}{10BW}$$

where BW = tne final i-f bandwidth of the FIM-2 (3 mc).

2-33. NOISE FIGURES OF MICROWAVE AMPLIFIERS.

2-34. To evaluate the noise figure of a microwave amplifier, the gain of the microwave amplifier, the overall noise figure of the microwave amplifier and the FIM-2, and the sensitivity and noise figure of the FIM-2 must first be determined.

2-35. To determine the gain of the microwave amplifier, proceed as outlined in paragraph 2-25.

2-36. To determine the sensitivity of the FIM-2, proceed as outlined in paragraph 2-22, steps a through y. Then proceed as outlined below.

a. Disconnect r-f cable assembly W1205 from the CAL in jack.

b. Adjust the IF GAIN control to obtain an output meter pointer deflection of 29 on the DB ABOVE 1 UV scale.

c. Rotate the SIGNAL CALIBRATOR OUTPUT ATTENUATOR control fully counterclockwise.

d. Reconnect r-f cable assembly W1205 to the CAL IN jack.

e. Adjust the SIGNAL CALIBRATOR OUTPUT ATTENUATOR control to obtain an output meter pointer deflection of 32 on the DB ABOVE 1 UV scale.

f. Note the -DBM MICROVOLTS dial indication on the -dbm scale. This is the sensitivity of the FIM-2 at the particular frequency of interest.

2-37. To determine the noise figure of the FIM-2, substitute the sensitivity (see paragraph 2-36) into the following equation

$$F_R = 109.24 - \text{Sensitivity of FIM-2 (in -dbm)}$$

where F_R = the noise figure of the FIM-2, in db.

2-38. To determine the overall noise figure of the microwave amplifier and the FIM-2, proceed as outlined in paragraph 2-22, steps a through y. Then proceed as outlined in the following steps.

a. Remove r-f cable assembly W1205 from the CAL IN jack.

b. Connect the output of the microwave amplifier under test to the CAL IN jack. (No input to the microwave amplifier.)

c. Adjust the IF GAIN control to obtain an output meter pointer deflection of 30 on the DB ABOVE 1 UV scale.

d. Connect r-f aable assembly W1205 to the input of the microwave amplifier under test.

e. Adjust the SIGNAL CALIBRATOR OUTPUT ATTENUATOR control to obtain an output meter pointer deflection of 33 on the DB ABOVE 1 UV scale.

f. Note the -DBM MICROVOLTS dial indication on the -dbm scale. This is the overall sensitivity of the microwave amplifier under test and the FIM-2 at the frequency of interest.

g. To determine the overall noise figure of the microwave amplifier under test and the FIM-2, substitute the sensitivity determined in steps f, above into the following formula

$$F_0 = 109.24 - \text{Sensitivity of amplifier and FIM-2 (in -dbm)}$$

where F_0 = the noise figure of the microwave amplifier and FIM-2, in db.

2-39. The noise figure of the microwave amplifier under test may now be evaluated from the following equation

$$F_A = 10 \log_{10} \left[F_0 - \frac{F_R - 1}{G} \right]$$

where F_A = the noise figure of the microwave amplifier, in db,

F_0 = the noise figure of the microwave amplifier and FIM-2, expressed as a power ratio,

F_R = the noise figure of the FIM-2, expressed as a power ratio,

G = the numeric power gain of the amplifier.

2-40. SHIELDING EFFICIENCY OF SCREEN ROOMS - HIGH ATTENUATION.

2-41. To determine the shielding efficiency of a screen room, proceed as outlined in the following steps.

a. Locate the FIM-2 and the appropriate calibrated antenna in the center of the screen room under test.

b. Locate a signal source and a transmitting antenna outside the screen room.

c. Orient the antennas (with the screen room door open) and tune the FIM-2 to the frequency of the signal source.

d. Determine the level of the signal intercepted by the calibrated antenna (see paragraph 2-12).

e. Close and lock the screen room door and again determine the level of the signal intercepted by the calibrated antenna.

f. The shielding attenuation, in db, is equal to the difference between the reading obtained in steps d and e, above.

2-42. RELATIVE POWER OF THE HARMONICS OF SIGNALS.

2-43. To determine the difference in power levels between a fundamental and its harmonics, first determine the power level of the fundamental (see paragraph 2-12). Then tune the FIM-2, in turn, to each of the harmonics of interest and determine their power levels. The difference in power levels can then be directly evaluated.

2-44. A-M ANALYSIS.

2-45. If the modulation frequency of the signal being analyzed falls within the audio range, it can be monitored by a 600-ohm headset connected to the AUDIO OUT jack, as shown in figure 2-17. To observe the a-m envelope, connect an oscilloscope having a 2-megohm input impedance to the VIDEO OUT jack, as shown in figure 2-17. To determine the percent modulation, proceed as outlined in the following steps.

a. Evaluate the level of the signal with the OUTPUT switch set to AVERAGE(E_{av}). See paragraph 2-12.

b. Evaluate the level of the signal with the OUTPUT switch set to PEAK (E_{peak}). See paragraph 2-18.

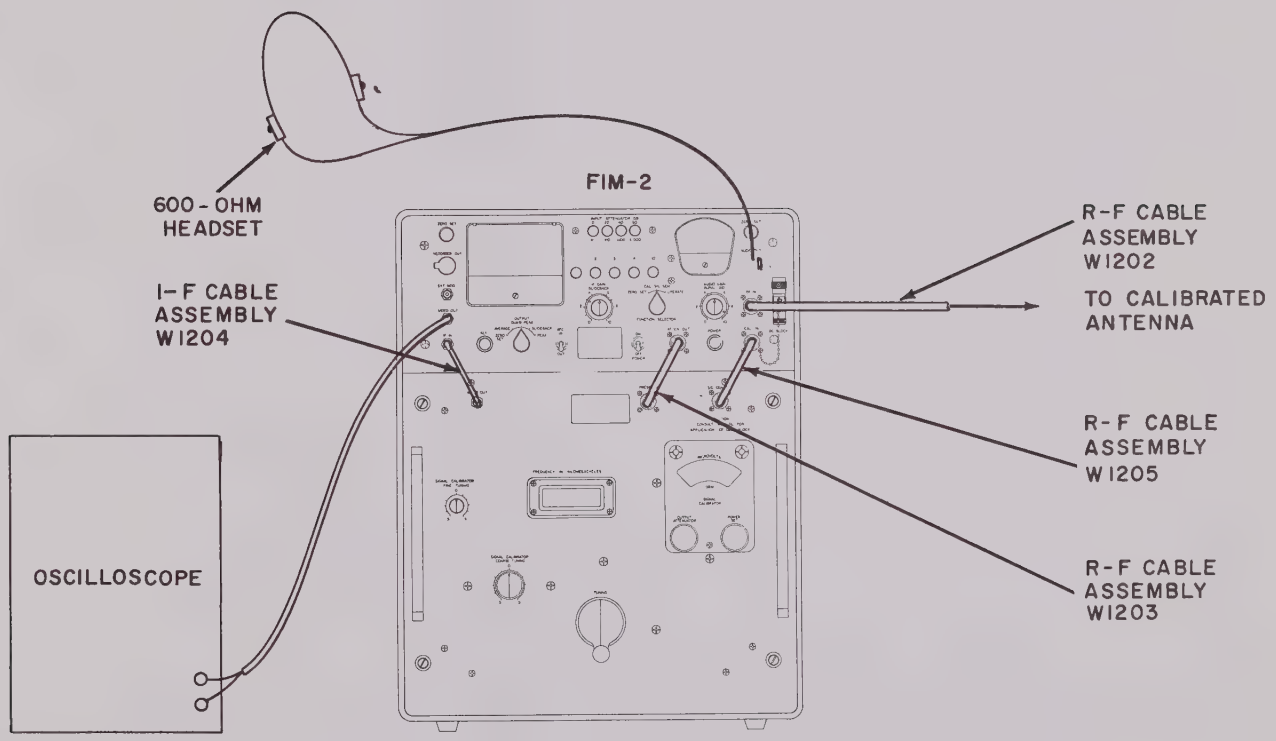


Figure 2-17. A-m Analysis, Equipment Set Up

c. The percent modulation can then be determined using the formula

$$\% \text{ Modulation} = \frac{E_{peak} - E_{av}}{E_{av}} \times 100$$

2-46. MICROWAVE PROPAGATION STUDIES.

2-47. Choose a point of relatively high intensity as a central location. Proceed radially outward, at fixed intervals, and record the output meter indications (see paragraph 2-12). Calculate the field intensity by the formula

$$E = \frac{4\pi}{\lambda}\sqrt{\frac{30P}{G}}$$

where E = the field intensity, in volts per meter,

P = the microwave power input to the FIM-2, in watts

G = the gain of the calibrated antenna, expressed as a power ratio, and

λ = the wavelength of the signal under measurement, in meters.

2-48. ANTENNA PATTERN MEASUREMENTS.

2-49. DIRECT RECEIVER METHOD. To make antenna pattern measurements by the direct receiver method, proceed as outlined in paragraph 2-22, steps a through y. Then proceed as outlined in the following steps.

a. Connect the antenna under test to the CAL IN jack, as shown in figure 2-18.

b. Connect a transmitting antenna to the SIG GEN OUT jack, as shown in figure 2-18.

c. Set the FUNCTION SEL switch to the CAL SIG GEN position.

d. Adjust the SIGNAL CALIBRATOR OUTPUT ATTENUATOR control

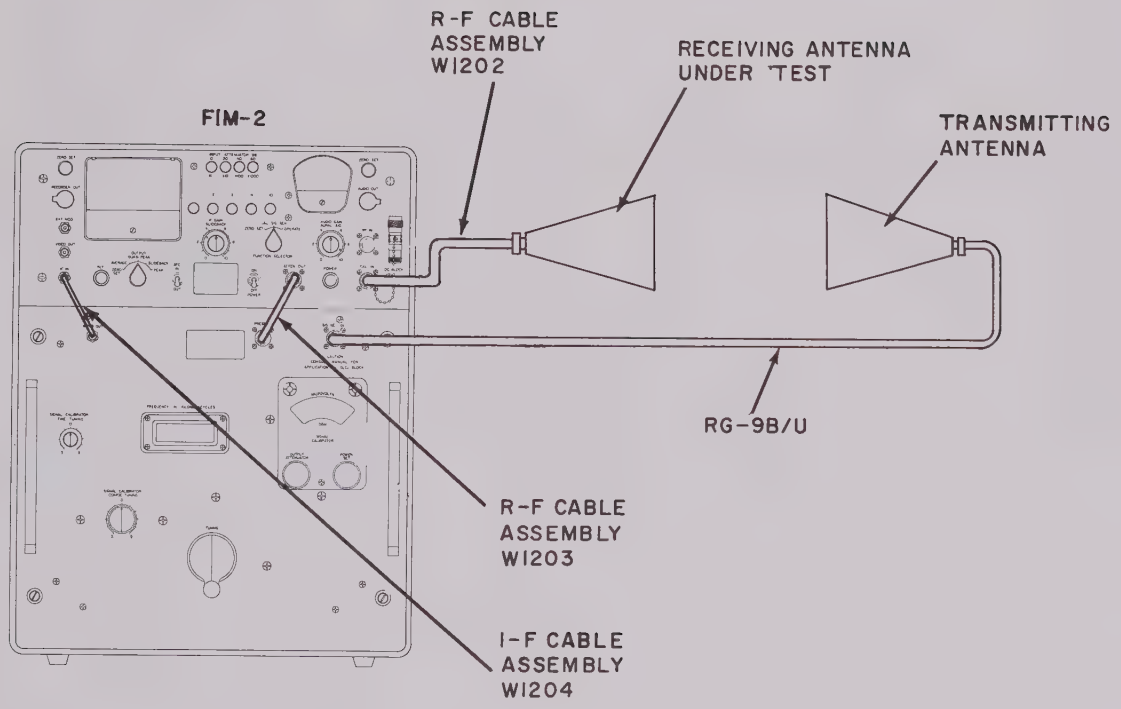


Figure 2-18. Antenna Pattern Measurements by the Direct Receiver Method, Equipment Set Up

to obtain a reference deflection of the output meter pointer at approximately 40 on the DB ABOVE 1 UV scale.

e. Rotate the antenna under test to peak the deflection of the output meter pointer.

f. Adjust the SIGNAL CALIBRATOR OUTPUT ATTENUATOR control to obtain an output meter pointer deflection of 60 on the DB ABOVE 1 UV scale.

g. Rotate the antenna under test and record, on polar coordinate paper, the output meter pointer deflection as a function of degrees of antenna rotation.

2-51. AUTOMATIC PATTERN RECORDER METHOD. To make antenna pattern measurements by the automatic pattern recorder method, proceed as outlined in paragraph 2-22, steps a through y. Then proceed as outlined in the following steps.

a. Connect the antenna under test to the CAL IN jack, as shown in figure 2-19.

b. Connect the transmitting antenna to the SIG GEN OUT jack, as shown in figure 2-19.

c. Set the FUNCTION SEL switch to the CAL SIG GEN position.

d. Adjust the SIGNAL CALIBRATOR OUTPUT ATTENUATOR control to obtain an output meter pointer deflection of approximately 40 on the DB ABOVE 1 UV scale.

e. Rotate the antenna under test to peak the deflection of the output meter pointer.

f. Adjust the SIGNAL CALIBRATOR OUTPUT ATTENUATOR control to obtain an output meter pointer deflection of 60 on the DB ABOVE 1 UV scale.

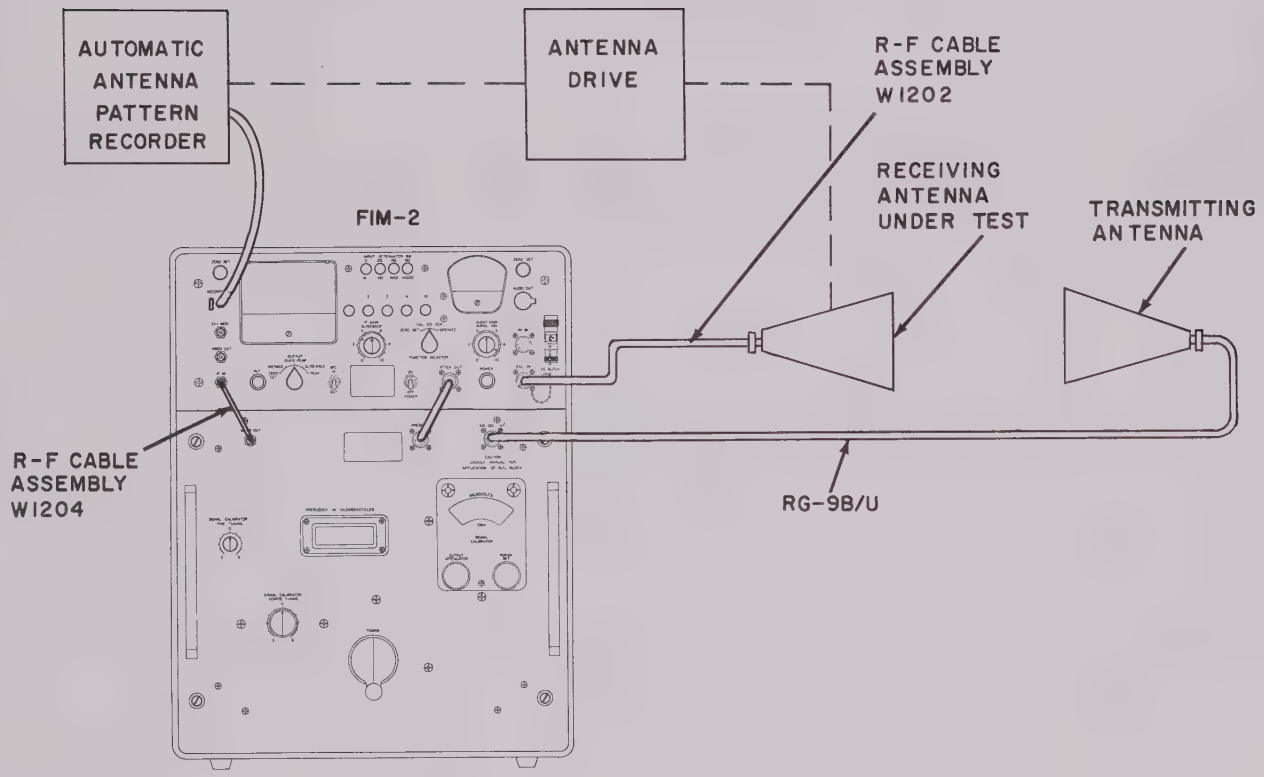


Figure 2-19. Antenna Pattern Measurements Using an Automatic Pattern Recorder, Equipment Set Up

	is the fundamental power in watts (class Ib and III)	below that of the fundamental, or 10^{-8} watts (707 microvolts into 50 ohms), whichever is greater The peak power of all harmonics above the third shall be at least 80 db below that of the fundamental, or 10^{-8} watts (707 microvolts into 50 ohms), whichever is greater	is the fundamental power in watts	
SUSCEPTIBILITY				
Radio frequency conducted.....	100,000 uv from a source having an impedance of 50 ohms (class Ib and III)	100,000 uv from a source having an impedance of 50	100,000 uv from a source having an impedance of 50	100,000 uv
Radio frequency radiated.....	100,000 uv with a nondirective antenna (class Ib and III)	100,000 uv from a 50-ohm source driving the calibrated antennas	100,000 uv from a 50-ohm source	100,000 uv
RECEIVER FRONT END REJECTION.....	60 db within tuning range; 80 db outside tuning range (class Ib and III)	60 db within tuning range; 80 db outside tuning range	60 db within tuning range; 80 db outside tuning range	60 db minimum

1 FIM-2 in AVERAGE position.

2 FIM-2 in PEAK position.

3 Not required providing contractor can furnish satisfactory evidence to the procuring activity that such measurements do not result in any significant data.

(a) Class Ia Equipment.

"This subclass applies to equipment and subsystems intended for installation in manned aircraft that do not carry missiles as operational combat armament. The interference control requirement for this class shall be in accordance with MIL-I-6181."

(b) Class Ib Equipment.

"Class Ib equipment shall be all class I equipment **** other than that included in class Ia ****. Requirements and tests for class Ib shall be in accordnace with *****. Class Ib specifically includes the following equipments:

a. Ground support equipment.

b. Air vehicles carrying missiles as operational combat armament.

c. All missiles."

(2) Class II Equipment.

"Class II equipment is the individual electrical and electronic equipment which is used with a surface system. Included are:

a. Electronic equipment such as receivers ***** and associated power supplies and subassemblies.

b. Electrical equipment used in conjunction with electronic equipment such as heaters *** et cetera.

c. Electrical power equipment such as generators *** used to furnish power to electronic equipment."

b. MIL-I-6181D.

"For Air Force use, the requirements of MIL-I-6181D shall apply only to equipment and subsystems intended for installation in manned aircraft that do not carry missiles as operational armament."

"The requirements of MIL-I-26600 shall apply in all other cases and specifically to the following classes of equipment:

a. Ground support equipment.

b. Air vehicles carrying missiles as operational combat armament.

c. All classes of missiles."

2-55. RADIATED INTERFERENCE MEASUREMENTS. When making radiated interference measurements, choose a suitable location for the conduction of the test. An anechoic chamber (or other shielded enclosure free from reflections) is prefereable. Broadband absorbing materials, such as loosely-spun mats, are available for lining the interior of a screen room to provide an area which is free from extraneous signals. By these methods power reflections may be reduced to less than two percent. If a microwave test chamber is not conveniently available, the measurements may be made in any suitable location, provided that the ambient interference level is at least 6 db below the allowable specified interference level.

2-56. The procedure for broadband radiated interference measurements is outlined in paragraph 2-17; that for narrowband radiated interference measurements in paragraph 2-12. The test set ups for these measurements are shown in figures 2-20. 2-21, 2-22, and 2-24.

2-57. ANTENNA CONDUCTED SPURIOUS EMANATIONS. When making antenna conducted spurious emanation measurements, the procedure outlined in paragraph 2-12 (narrowband) and 2-17 (broadband) are employed. The test set ups for these measurements are shown in figures 2-20, 2-21, 2-22, and 2-23.

2-58. CONDUCTED SUSCEPTIBILITY MEASUREMENTS. When making conducted susceptibility measurements, adjust the FIM-2 for an output of 100,000 microvolts (signal generator operation). Connect the component under test to the SIG GEN OUT jack via r-f cable assembly W1202 and d-c blocking capacitor C1201, as shown in figure 2-24.

CAUTION:

WHEN MAKING CONDUCTED SUSCEPTIBILITY TESTS, BE SURE TO CONNECT D-C BLOCKING CAPACITOR C1201 BETWEEN THE SIG GEN OUT JACK AND THE LINE STABILIZATION NETWORK, AS SHOWN IN FIGURE 2-24. FAILURE TO DO SO MAY RESULT IN DAMAGE TO THE SIGNAL CALIBRATOR OUTPUT ATTENUATOR PROBE.

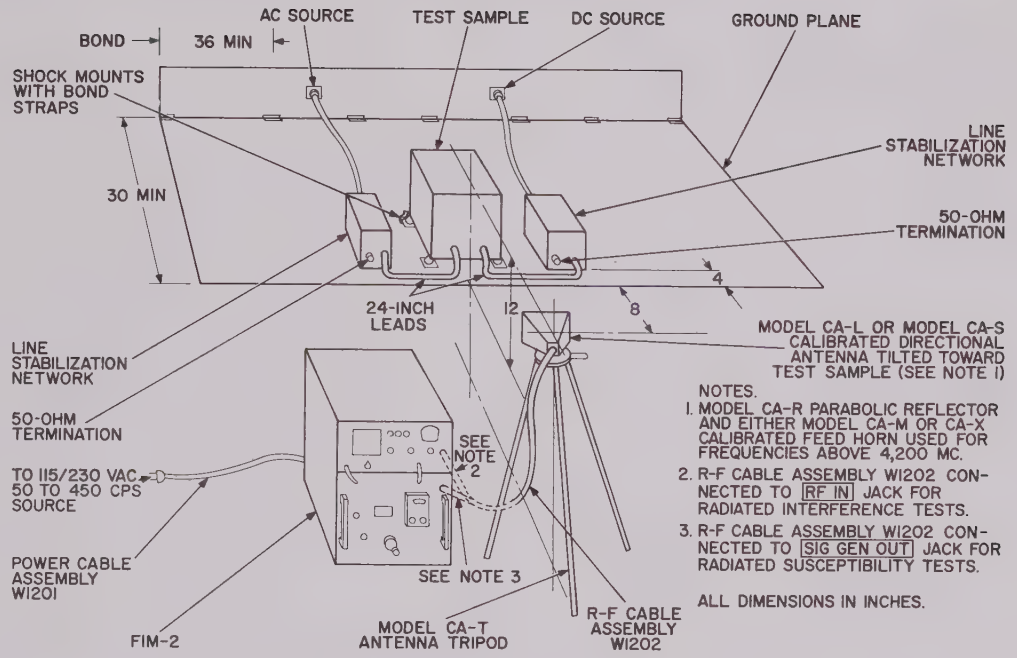

AC SOURCE
TEST SAMPLE
DC SOURCE
GROUND PLANE
BOND
36 MIN
SHOCK MOUNTS WITH BOND STRAPS
LINE STABILIZATION NETWORK
30 MIN
50-OHM TERMINATION
4
24-INCH LEADS
12
8
MODEL CA-L OR MODEL CA-S CALIBRATED DIRECTIONAL ANTENNA TILTED TOWARD TEST SAMPLE (SEE NOTE 1)
LINE STABILIZATION NETWORK
50-OHM TERMINATION
SEE NOTE 2
TO 115/230 VAC 50 TO 450 CPS SOURCE
POWER CABLE ASSEMBLY W1201
SEE NOTE 3
FIM-2
MODEL CA-T ANTENNA TRIPOD
R-F CABLE ASSEMBLY W1202
NOTES.
1. MODEL CA-R PARABOLIC REFLECTOR AND EITHER MODEL CA-M OR CA-X CALIBRATED FEED HORN USED FOR FREQUENCIES ABOVE 4,200 MC.
2. R-F CABLE ASSEMBLY W1202 CONNECTED TO [RF IN] JACK FOR RADIATED INTERFERENCE TESTS.
3. R-F CABLE ASSEMBLY W1202 CONNECTED TO [SIG GEN OUT] JACK FOR RADIATED SUSCEPTIBILITY TESTS.
ALL DIMENSIONS IN INCHES.

Figure 2-20. Radiated Interference and Susceptibility Measurements, Typical Test Set Up (MIL-I-26600, Class Ib Equipment)

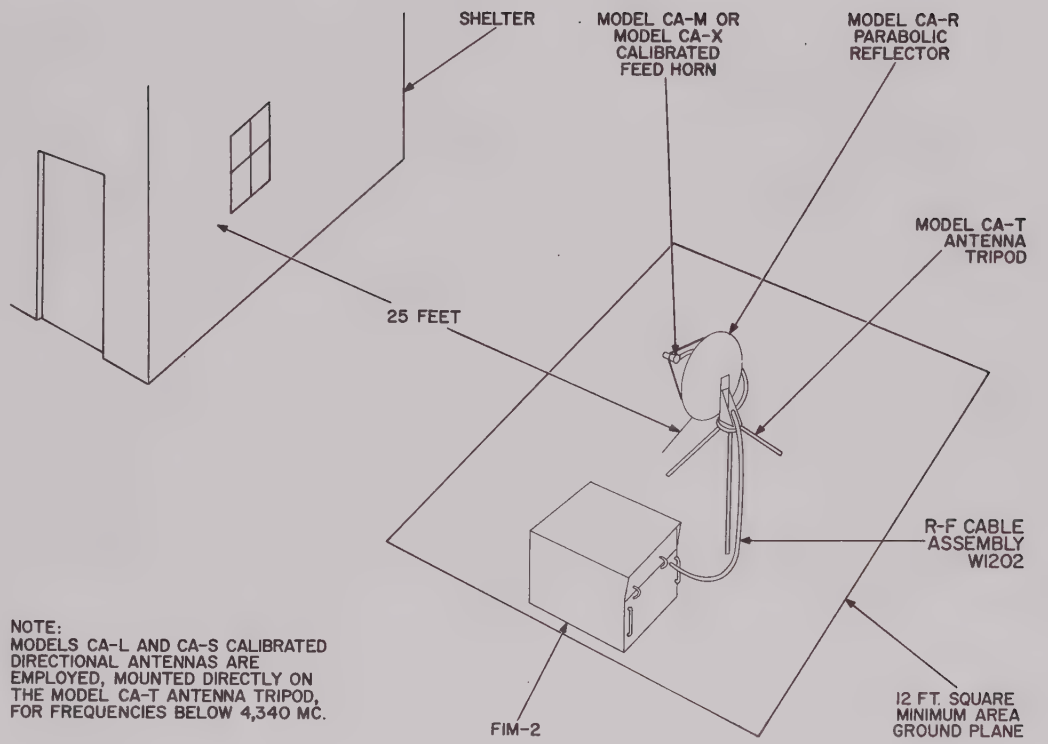


Figure 2-21. Radiated Interference Measurements, Typical Test Set Up (MIL-I-26600, Class II Equipment)

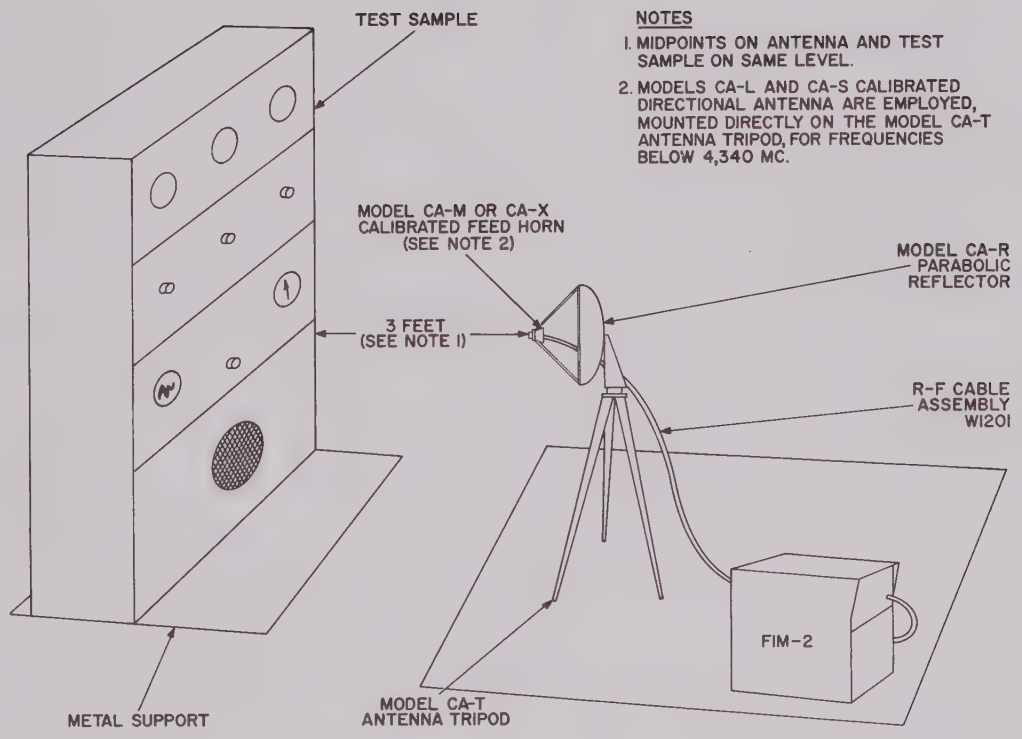

TEST SAMPLE
NOTES
1. MIDPOINTS ON ANTENNA AND TEST SAMPLE ON SAME LEVEL.
2. MODELS CA-L AND CA-S CALIBRATED DIRECTIONAL ANTENNA ARE EMPLOYED, MOUNTED DIRECTLY ON THE MODEL CA-T ANTENNA TRIPOD, FOR FREQUENCIES BELOW 4,340 MC.
MODEL CA-M OR CA-X CALIBRATED FEED HORN (SEE NOTE 2)
MODEL CA-R PARABOLIC REFLECTOR
3 FEET (SEE NOTE 1)
R-F CABLE ASSEMBLY W1201
FIM-2
METAL SUPPORT
MODEL CA-T ANTENNA TRIPOD

Figure 2-22. Radiated Interference Measurements, Typical Test Set Up (MIL-I-26600, Class III Equipment)

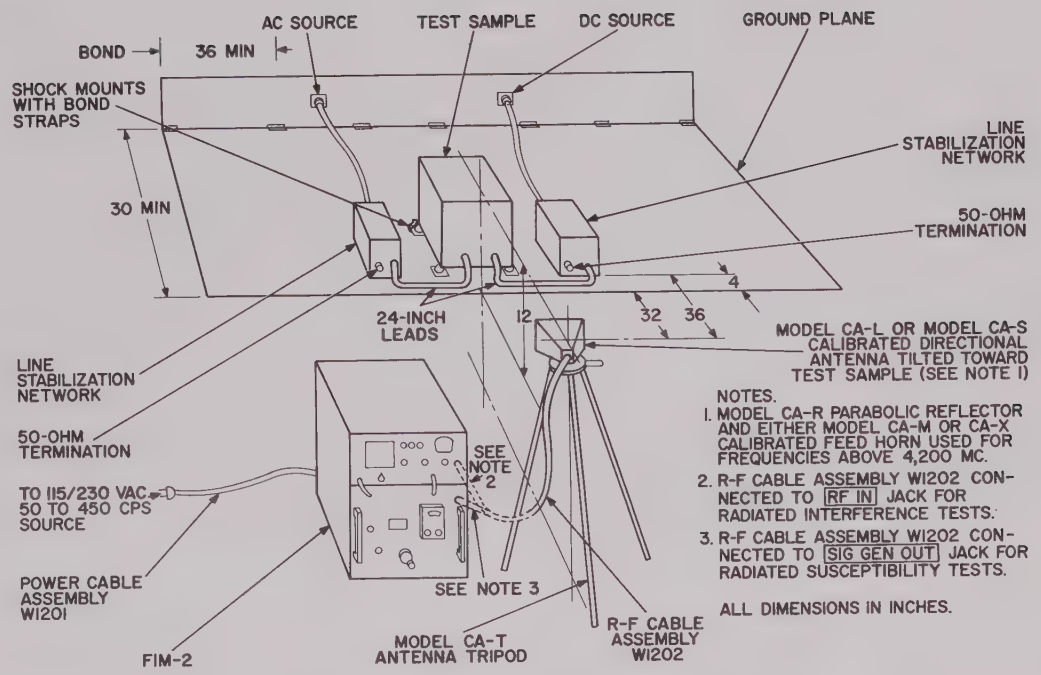

AC SOURCE
TEST SAMPLE
DC SOURCE
GROUND PLANE
BOND
36 MIN
SHOCK MOUNTS WITH BOND STRAPS
LINE STABILIZATION NETWORK
30 MIN
50-OHM TERMINATION
4
24-INCH LEADS
12
32
36
MODEL CA-L OR MODEL CA-S CALIBRATED DIRECTIONAL ANTENNA TILTED TOWARD TEST SAMPLE (SEE NOTE 1)
LINE STABILIZATION NETWORK
50-OHM TERMINATION
SEE NOTE 2
TO 115/230 VAC 50 TO 450 CPS SOURCE
POWER CABLE ASSEMBLY W1201
SEE NOTE 3
FIM-2
MODEL CA-T ANTENNA TRIPOD
R-F CABLE ASSEMBLY W1202
NOTES.
1. MODEL CA-R PARABOLIC REFLECTOR AND EITHER MODEL CA-M OR CA-X CALIBRATED FEED HORN USED FOR FREQUENCIES ABOVE 4,200 MC.
2. R-F CABLE ASSEMBLY W1202 CONNECTED TO RF IN JACK FOR RADIATED INTERFERENCE TESTS.
3. R-F CABLE ASSEMBLY W1202 CONNECTED TO SIG GEN OUT JACK FOR RADIATED SUSCEPTIBILITY TESTS.
ALL DIMENSIONS IN INCHES.

Figure 2-23. Radiated Interference and Susceptibility Measurements, Typical Test Set Up (MIL-I-6181D)

plays r-f energy as a function of both time and frequency), these two instruments provide complete facilities for the analysis of any interference signal in terms of absolute power, rise time, decay time, pulse width, pulse repetition rate, relative amplitude of main and side lobes, type of modulation, symmetry of spectrum, and many other characteristics. Remedial measures are greatly facilitated by such a thorough analysis of the interference signal. Typical synchroscope-spectrum analyzer signals, both as functions of time and frequency, are shown in figure 2-25.

2-59. The test for conducted susceptibility shall be considered successful if the application of the 100,000 microvolt signal produces no change in indication, malfunction, or degradation of performance of the test sample.

2-60. RADIATED SUSCEPTIBILITY MEASUREMENTS. When making radiated susceptibility measurements, adjust the FIM-2 for an output of 100,000 microvolts (signal generator operation). Connect the appropriate calibrated antenna to the SIG GEN OUT jack, as shown in figure 2-20 (MIL-I-26600) or figure 2-23 (MIL-I-6181D). The test for radiated susceptibility shall be considered successful if the component under test shows no change in indication, malfunction, or degradation of performance.

2-61. RECEIVER FRONT END REJECTION. When making receiver front end rejection measurements, tune the receiver under test to any frequency within its tuning range. Determine the level of the minimum perceptible signal at that frequency. Then scan the band of the receiver with the FIM-2 set to an output 60 db above the minimum perceptible signal (signal generator operation). The test shall be considered successful if the receiver rejection is at least 60 db.

2-62. Repeat the above paragraph with the FIM-2 set to an output 80 db above the minimum perceptible signal level at frequencies outside the tuning range of the receiver under test. The test shall be successful if the receiver rejection is at least 80 db.

2-63. AUXILIARY EQUIPMENT.

2-64. When the FIM-2 is used in conjunction with the Polarad Model TSA-S Combination Synchroscope-Spectrum Analyzer (which dis-

plays r-f energy as a function of both time and frequency), these two instruments provide complete facilities for the analysis of any interference signal in terms of absolute power, rise time, decay time, pulse width, pulse repetition rate, relative amplitude of main and side lobes, type of modulation, symmetry of spectrum, and many other characteristics. Remedial measures are greatly facilitated by such a thorough analysis of the interference signal. Typical synchroscope-spectrum analyzer signals, both as functions of time and frequency, are shown in figure 2-25.

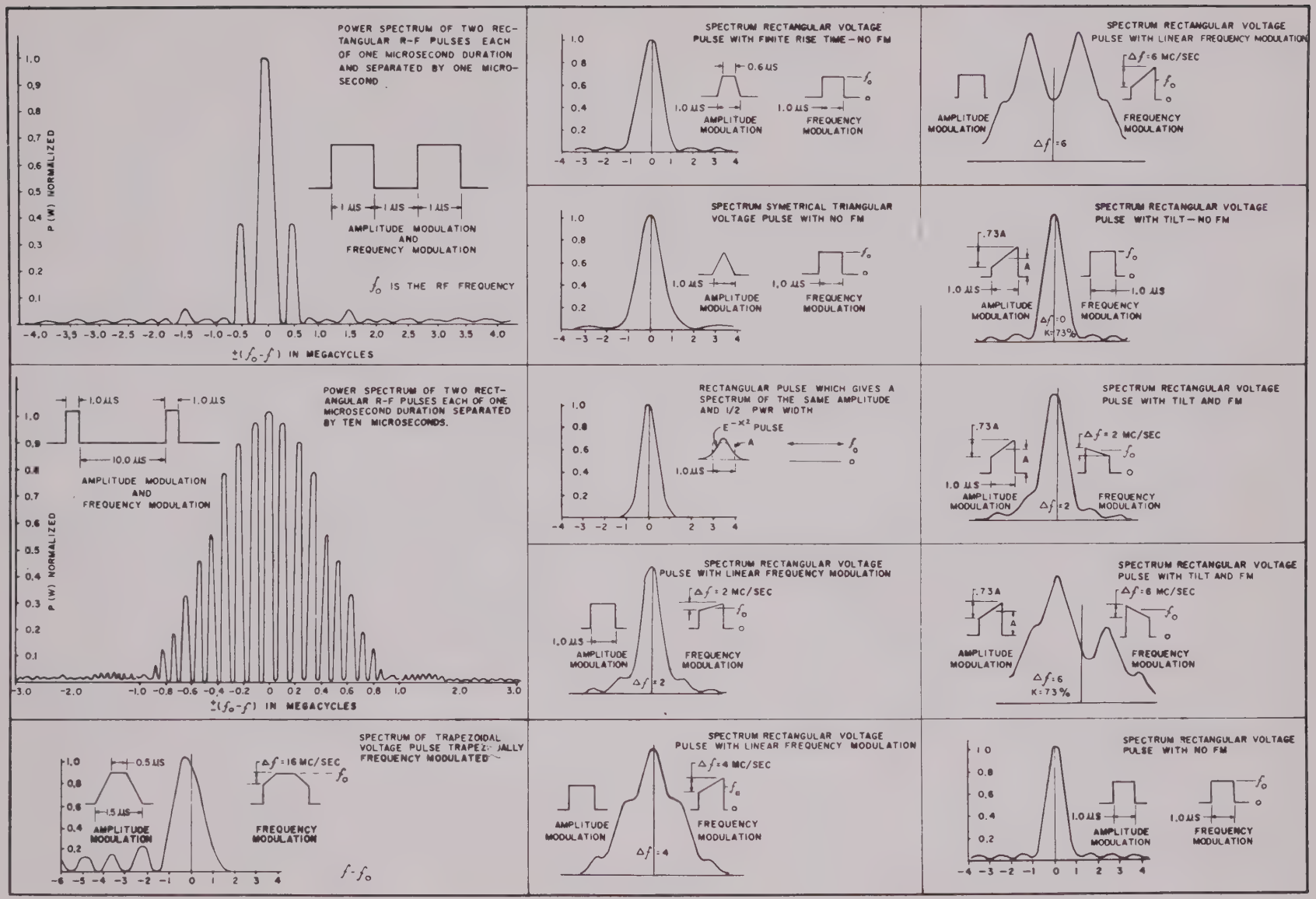

POWER SPECTRUM OF TWO RECTANGULAR R-F PULSES EACH OF ONE MICROSECOND DURATION AND SEPARATED BY ONE MICROSECOND
1 μS 1 μS 1 μS
AMPLITUDE MODULATION AND FREQUENCY MODULATION
f_o IS THE RF FREQUENCY
P (W) NORMALIZED
±(f_o-f) IN MEGACYCLES
SPECTRUM RECTANGULAR VOLTAGE PULSE WITH FINITE RISE TIME—NO FM
0.6 μS
1.0 μS
AMPLITUDE MODULATION
FREQUENCY MODULATION
SPECTRUM RECTANGULAR VOLTAGE PULSE WITH LINEAR FREQUENCY MODULATION
Δf=6 MC/SEC
Δf=6
SPECTRUM SYMETRICAL TRIANGULAR VOLTAGE PULSE WITH NO FM
SPECTRUM RECTANGULAR VOLTAGE PULSE WITH TILT—NO FM
.73A
Δf=0
K=73%
POWER SPECTRUM OF TWO RECTANGULAR R-F PULSES EACH OF ONE MICROSECOND DURATION SEPARATED BY TEN MICROSECONDS.
1.0 μS
1.0 μS
10.0 μS
AMPLITUDE MODULATION AND FREQUENCY MODULATION
RECTANGULAR PULSE WHICH GIVES A SPECTRUM OF THE SAME AMPLITUDE AND 1/2 PWR WIDTH
E^{-X^2} PULSE
SPECTRUM RECTANGULAR VOLTAGE PULSE WITH TILT AND FM
Δf=2 MC/SEC
Δf=2
SPECTRUM RECTANGULAR VOLTAGE PULSE WITH LINEAR FREQUENCY MODULATION
Δf=2 MC/SEC
Δf=2
SPECTRUM RECTANGULAR VOLTAGE PULSE WITH TILT AND FM
Δf=6 MC/SEC
Δf=6
K=73%
SPECTRUM OF TRAPEZOIDAL VOLTAGE PULSE TRAPEZOIDALLY FREQUENCY MODULATED
0.5 μS
1.5 μS
Δf=16 MC/SEC
$f-f_o$
SPECTRUM RECTANGULAR VOLTAGE PULSE WITH LINEAR FREQUENCY MODULATION
Δf=4 MC/SEC
Δf=4
SPECTRUM RECTANGULAR VOLTAGE PULSE WITH NO FM

Figure 2-25. Typical Synchroscope-Spectrum Analyzer Displays

POLARAD
PROVEN RELIABILITY

POLARAD ELECTRONICS CORPORATION

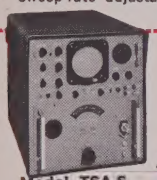
43-20 34th Street
Long Island City 1, New York

World Leader in Microwave Instrumentation

SPECTRUM ANALYZERS—10-100,000 MC

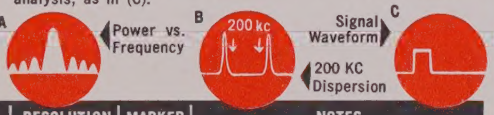
Undisputed leader in the field of microwave spectrum analysis, Polarad offers the widest, most diversified line of equipments for precise and meaningful quantitative and qualitative evaluation of any signal, regardless of complexity or frequency content. The features listed below are generally common to all Polarad Spectrum Analyzers:

- Direct-reading UNIDIAL® tuning —no klystron mode-setting!
- Frequency Dial Accuracy, ±1%
- Sweep-rate adjustable, 1-30 cps
- Non-contacting klystron-cavity chokes for noiseless tuning, optimum stability
- Five-inch flat-face CRT display
- Compatible with Multi-pulse Spectrum Selector SD-1

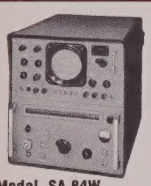


Model TSA-S
Dual-Purpose Spectrum Analyzer/ Synchroscope

TSA SERIES. 10-44,000 MC in 5 plug-in tuning units. Model TSA provides power vs. freq. display (A), below. Model TSA-S provides both (A) and synchroscope display (B). Wide-dispersion Model TSA-W provides (A) display, up to 80 MC (full screen), down to 60 KC for wide pulse analysis, as in (C).

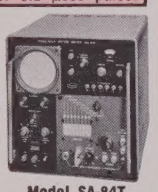


MODEL	DISPERSION	RESOLUTION	MARKER	NOTES
TSA	25 KC-25 MC	1-80 KC	±14 MC	Sensitivity —50 to —100 dbm
TSA-S	400 KC-25 MC	5/50/500 KC and 5 MC	±14 MC	Sensitivity —50 to —100 dbm. Synch. Sweep Rates: 2 μsec to 0.1 sec/cm
TSA-W	25 KC-80 MC	1-80 KC	±40 MC	Sensitivity —50 to —100 dbm Displays spectra of 0.1 μsec pulses



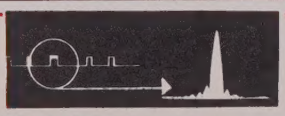
Model SA-84W
Wide-Band Spectrum Analyzer

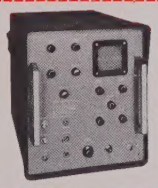
SA SERIES Universal Spectrum Analyzers provide complete coverage from 10-40,880 MC in compact, self-contained form. The new lightweight transistorized unit Model SA-84T is truly portable, and will operate from either the AC line or 12 V DC. The SA-84W wide-band design features exceptionally broad frequency coverage and very wide dispersion in a single-unit package.



Model SA-84T
Transistorized Portable

MODEL	DESCRIPTION	DISPERSION	RESOLUTION	NOTES
SA-84T	Transistorized Universal	400 KC-25 MC adjustable	20 KC	Internal Marker, ±13 MC Sensitivity, —50 to —105 dbm.
SA-84	Standard Universal	500 KC- 5 MC (up to 55 MC) 500 KC-25 MC (above 55 MC) adj.	20 KC	Variable Internal Marker comparable sensitivity to SA-84T
SA-84W	Wide-Dispersion Universal	25 KC-10 MC 25 KC-80 MC 240 to 40,880 MC	1-80 KC variable	Crystal-controlled markers over entire freq. range. Log-linear display. Accurate IF attenuator. Comparable sensitivity to SA-84T





MULTI-PULSE SPECTRUM SELECTOR: When used with any Polarad Spectrum Analyzer, this instrument permits isolation and spectrum analysis of any individual pulse in a complex coded signal.

Model SD-1

MODEL DA-70, 50-100 KMC Spectrum Analyzer. Dispersion adj. 50-1000 MC. Resolution 1 MC. High IF assures image rejection, prevents video detection. Sensitivity, —50 dbm, nom. Frequency marker for △F measurements.

MODEL WSA Wide-Band Spectrum Analyzer. 10-40,000 MC in 20 push-button-selected bands. Narrow mode: 1-25 MC dispersion, 20 KC resolution. Wide mode: 50-4,000 MC dispersion, 1.5 MC resolution. Freq. marker to 4 KMC. End-markers indicate band limits. Center-marker for wide-to-narrow switching without signal loss.

Model WSA

USE THIS CARD for complete specifications or call your local Polarad representative (see the Yellow Pages).

SIGNAL GENERATORS—0.5-50 KMC

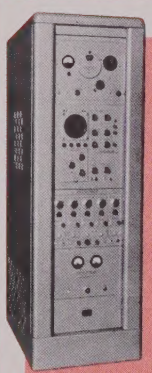
Model PMR
UHF Signal Generator

MSG-2R
Signal Generator

Model MSG-34
Ultra-Broadband Signal Generator

500-11,000 MC SERIES. These superb instruments incorporate every important mechanical and electronic advancement known to the art, including several Polarad exclusives, such as UNIDIAL® tuning. Direct-reading frequency dials, accurate to ±1%. High-stability non-contacting klystron-cavity shorts for noiseless tuning, permanent accuracy. Continuously-variable, directly-calibrated attenuators. Modulation: internal pulse, FM, sq-wave; external pulse and multi-pulse. Delayed and undelayed sync. outputs. The Model PMR provides exceptional FM capability through the use of a special plug-in modulator (supplied).

MODEL	FREQUENCY-KMC	CALIBRATED POWER OUTPUT	INTERNAL MODULATION
PMR	0.5 - 1.0	0.5 MW (—3 dbm) to —127 dbm	sq-wave, 40-4,000 pps } FM with plug-in Pulse, 10-10,000 pps } modulator
KSS (Signal Source)	1.05-11.0 (4 plug-ins)	Uncalibrated. Power Output: 14-400 MW, depending on freq.	sq-wave, 10-10,000 pps (external pulse, sq-wave, FM)
PMX	4.45-11.0 (2 plug-ins)	1 MW (0 dbm) to —127 dbm	All instruments in this group: pulse modulation: 10-10,000 pps. *pulse width: 0.2-10 μsec. pulse delay: 2-2,000 μsec. square-wave modulation: 10-10,000 pps. FM deviation: ±2.5 MC min. *0.3-10 μsec. in MSG-1R and 2R.
MSG-34 (Ultra Broadband)	4.2 -11.0 digital freq. indicator	1 MW (0 dbm) to —127 dbm	
MSG-1R	0.95- 2.40	1 MW (0 dbm) to —127 dbm	
MSG-2R	2.0 - 4.60	1 MW (0 dbm) to —127 dbm	



MULTI-PULSE CODE-MODULATED MICROWAVE SIGNAL GENERATOR

Model B — 0.95 to 10.75 KMC 4 plug-in tuning units. 5 independent adjustable channels, each with variable pulse width and delay. Built-in precision scope.

EHF SERIES Signal Generators (frequency and power calibrated) and Signal Sources (frequency calibrated) operate CW, with 1 KC int. modulation, or ext. mod'n. See chart for tuning unit ranges and designations. Also available: SG-1218 Generator or SS-1218 Source, 12.4-17.5 KMC.

EHF Series
Signal Generators

EHF SIGNAL GENERATOR Tuning Unit	Frequency Range	EHF SIGNAL SOURCE Tuning Unit
G1822-1	18,000 to 22,000 mc	S1822-1
G2225-1	22,000 to 25,000 mc	S2225-1
G2427-1	24,700 to 27,500 mc	S2427-1
G2730-1	27,270 to 30,000 mc	S2730-1
G3033-1	29,700 to 33,520 mc	S2933-1
G3336-1	33,520 to 36,250 mc	S3336-1
G3540-1	35,100 to 39,700 mc	S3540-1
	39,600 to 46,000 mc	S4046-1
	45,900 to 50,000 mc	S4650-1

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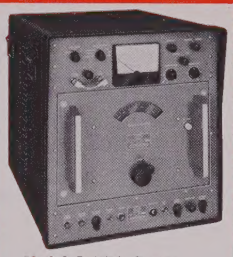
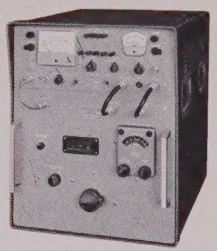
MICROWAVE RECEIVERS & FIELD INTENSITY METERS, 0.4—84.2 KMC

Polarad, pioneer in microwave receiver development, offers the industry's most complete and diversified line of precisely-calibrated, wide-range receivers and radio-interference-and-field-intensity(RI/FI)meters. The new transistorized portables feature built-in inverters for optional 12 VDC operation. **Only Polarad** offers **both** calibration techniques: Integral signal generator (Model FIM-2) for wide-range, absolute level calibration **or** (Model CFI) integral impulse generator for simplicity, convenience. All units have audio, video, and recorder outputs. All display output directly in db.

Model CFI Portable Transistorized Calibrated RI/FI — Meter/Receiver



Model R Wide-Range Multipurpose Microwave Receiver



Model FIM-2 Absolute-Calibrated RI/FI—Meter/Receiver

Model TR Transistorized Portable Wide-Range Multipurpose Receiver

Both the CFI and FIM-2 have Category A Air-Force Approval Per MIL-I-26600 and MIL-I-6181

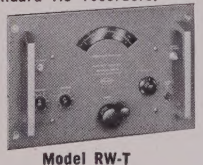
MODEL	DESCRIPTION	FREQUENCY RANGE	MINIMUM SENSITIVITY ⑥	SELECTIVITY & TUNING (see notes below)	CHARACTERISTICS
CFI	TRANSISTORIZED CALIBRATED RI/FI METER/RECEIVER (Category A AF approved)	1-10 KMC (0.95-11.26 as receiver)	—90 to —84 dbm	① ② ③ ④	• **Digital** frequency dial • AM, FM, CW, Pulse reception • AFC, AGC (60 db linearity range!)
FIM-2	CALIBRATED RI/FI METER/RECEIVER (Category A AF approved)	1-10 KMC Check Polarad for 21 KMC Coverage.	—81 dbm	① ② ③ ④	• Single UNIDIAL® tunes both receiver and signal generator. • First system to determine radiated RF interference and susceptibility.
TR	TRANSISTORIZED MICROWAVE RECEIVER	0.95-11.26 KMC	—90 dbm	① ③ ④ ⑤	• AFC, AGC circuits. • **Digital** frequency dial • AFC, AGC (60 db linearity range!)
R	ULTRA-WIDE-BAND MICROWAVE RECEIVER	0.4-84.2 KMC	—85 to —50 dbm	② ③ ⑤	• UNIDIAL® direct-reading freq. control • AFC, AGC (60 db linearity range!)

• Calibrated antenna system includes both omni (broad-band) and directionals for each range.
• Attenuation: 0-80 db in 1 db steps
• Front panel metering of average, peak, slide-back peak, or quasi-peak RF level.

These versatile precision devices are really **four instruments in one:**
• AM, FM, CW, MCW, Pulse Receiver.
• Field-intensity receiver.
• Pulse, pulse-time position demodulator.
• Sensitive power meter.

① Impulse Bandwidth: 1, 5, or 8 mc (Model FIM-2, 5MC only).
② Image and Spurious Response Rejection: better than 60 db. (up to 11.26 KMC in Model R)
③ Four plug-in tuning units cover entire range (Model R uses 9) and all are direct-reading, calibrated to ±1%.
④ Maximum RF input, 3 Volts.
⑤ Video bandwidth: 3.5 MC (Model TR) 2 MC (Model R)
⑥ Depending upon frequency.

ANTENNA PATTERN TUNING UNIT 2-75 KMC: Used with Model R receiver. External Mixer with flexible cable. Locate up to 75 ft. from receiver, at or near antenna. Internal 1 KC sweep — compatible with all standard AC recorders.



Model RW-T

CALIBRATED ANTENNAS
1,000 to 10,000 MC

TEST ANTENNAS
1,000 to 40,000 MC

TRANSISTORIZED IMPULSE GENERATOR Model IC-120: 1 MC-10 KMC. Calibrates microwave receivers for RI/FI work. Signal source for spectrum analyzers. Generates 0.02 nanosec. pulses.

ALL-CERAMIC REFLEX KLYSTRONS Maximum resistance to shock, vibration, temperature extremes. Guaranteed operation to 250°C, without cooling. Stable, low noise, low microphonics. (X series has guaranteed minimum 200 mw output.) Request complete application data.

TYPE	FREQ. RANGE—KMC	RETMA
ZV1012	0.5 - 3.0	7506
ZV1010	0.7 - 3.0	7505
ZV1010X	0.95- 2.8	——
ZV1021	1.0 - 4.0	——
ZV1021X	1.0 - 4.0	——
ZV1009	1.5 - 6.0	7049
ZV1009X	1.7 - 5.0	——
ZV1011	4.0 -11.0	8052

SPECIAL INSTRUMENTATION for MICROWAVE DEVELOPMENT, PRODUCTION, CHECKOUT.

Condensed listing of precision instruments developed by Polarad to meet a wide range of requirements.

Model MP-1A
Five-Channel Coded Multipulse Generator

CODED MULTI-PULSE GENERATOR Model MP-1A. Five independently adjustable channels generate coded multipulse trains. Permits independent external PTM of each channel. 10-10,000 cps group rep-rate, each pulse adj. 0.2 2 μsec. Delay, 0-300 μsec.

PULSE JITTER TESTER. Model PJ-1 Measures and displays magnitude and waveform of:
Relative jitter: 5/10/100 nanosec. full scale
Pulse-width jitter: 5/10/100 nanosec full scale
Rep-rate jitter: 5/10/100 nanosec, 1/10/100 μsec. full scale

MICROWAVE TUBE TESTER. Model K-200. Simple as conventional tube tester, monitors cathode, anode, grid, reflector voltages and currents, checks shorts, fil. continuity. Tests klystrons (internal/external-cavity) pencil triodes, rocket and lighthouse tubes.

PRECISION NOISE GENERATOR. Model N-1. 1KC-500MC source for direct measurement of noise figure (1-20 db, accurate to ±0.25 db) of VT and transistor circuits.

TRANSISTORIZED MICROWAVE POWER METER. Model P-3. Measures absolute power instantly, directly, 10-40,000 MC with 5 interchangeable thermistor mounts. 0.01 MW full scale sensitivity. Line or battery operated, only 6 lbs.

BG-6789

I would like more information and specifications on: (circle)

SPECTRUM ANALYZERS
TSA SA-84 DA-70
TSA-S SA-84T WSA
TSA-W SA-84W SD-1

SIGNAL GENERATORS
PMR MSG-1R EHF
MSG-34 MSG-2R KSS
PMX B

RECEIVERS and RI/FI METERS
R RW-T CFI
TR FIM-2 IC-120
ANTENNAS

LABORATORY EQUIPMENT
PJ-1 P-3 MP-1A
N-1 KLYSTRONS K-200

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